Ordering number: EN 3987A

Monolithic Linear IC

SANYO No.3987 A

LA1826

AM/FM Tuner with MPX Stereo Demodulator

OVERVIEW

The LA1826 is an AM/FM tuner with MPX stereo demodulator which integrates most of the components of a complete receiver system in a monolithic linear IC, making it ideal for headphone radios and radio cassette recorders.

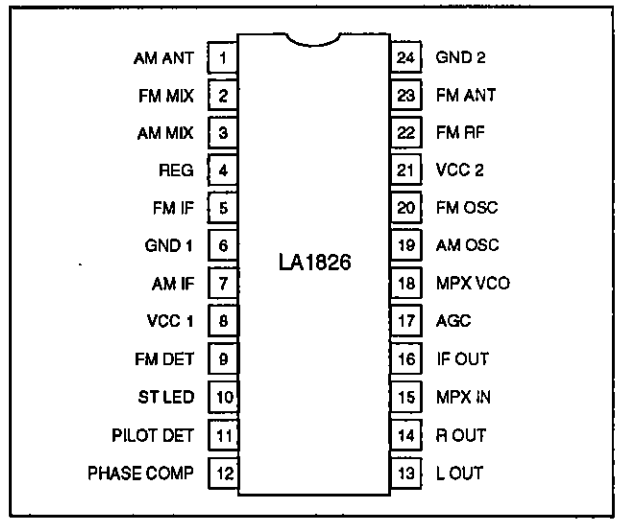
The LA1826 features a stereo indicator driver, can receive SW broadcasts, and operates with low carrier leakage, low power consumption and high stability.

The LA1826 can be operated from a 1.8 to 6.0 V supply and is available in a 24-pin shrink DIP.

FEATURES

- Stereo indicator driver
- Few external components
- Receives SW broadcasts
- High stability
- Low carrier leakage
- Low power consumption
- 1.8 to 6.0 V supply
- 24-pin shrink DIP

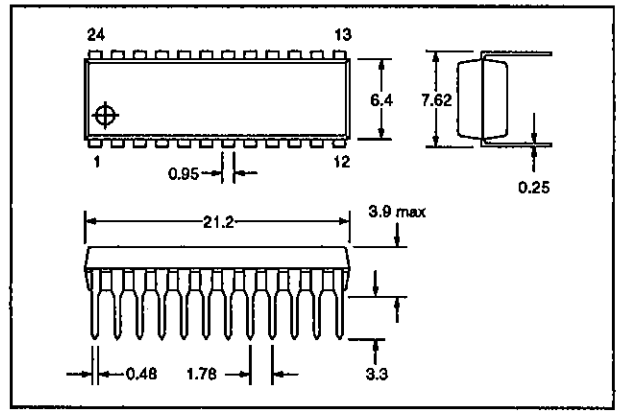
Pin Assignment



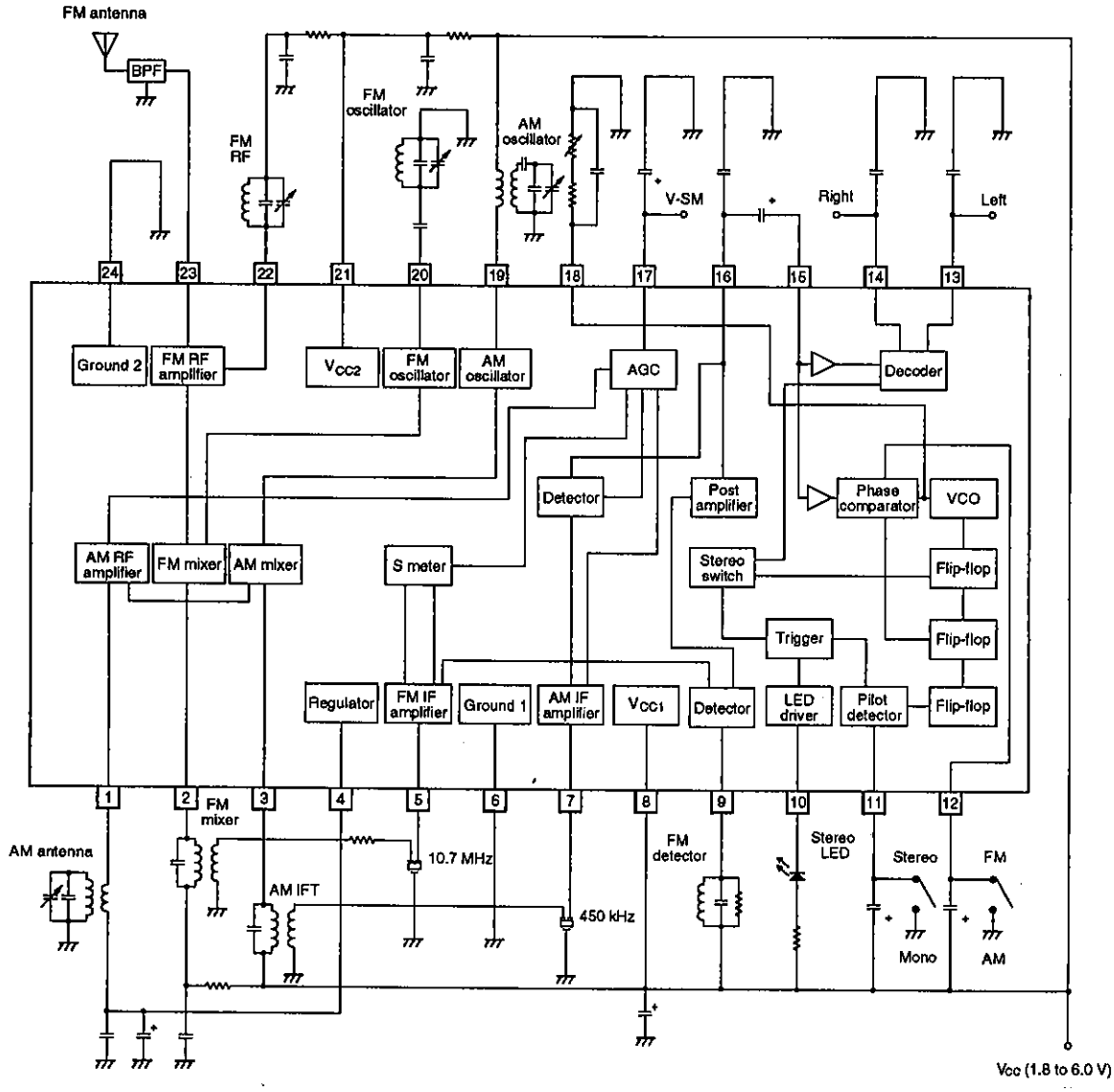
Package Dimensions

Unit: mm

3067-DIP24S



BLOCK DIAGRAM



PIN DESCRIPTION

Number	Name	Description
1	AM ANT	AM antenna input
2	FM MIX	FM mixer output
3	AM MIX	AM mixer output
4	REG	Voltage regulator output
5	FM IF	FM IF amplifier input
6	GND 1	Ground 1
7	AM IF	AM IF amplifier input
8	VCC 1	Supply voltage 1
9	FM DET	Quadrature detection input
10	ST LED	LED driver output
11	PILOT DET	Pilot sync detect filter

Number	Name	Description
12	PHASE COMP	PLL loop filter, AM/FM change-over
13	L OUT	MPX left-channel output
14	R OUT	MPX right-channel output
15	MPX IN	MPX input
16	IF OUT	AM and FM output
17	AGC	Automatic gain control
18	MPX VCO	PLL voltage-controlled oscillator
19	AM OSC	AM oscillator input
20	FM OSC	FM oscillator input
21	VCC 2	Supply voltage 2
22	FM RF	FM RF amplifier output
23	FM ANT	FM antenna input
24	GND 2	Ground 2

SPECIFICATIONS

Absolute Maximum Ratings

T_a = 25 °C

Parameter	Symbol	Rating	Unit
Supply voltage	V_{CC}	7	V
Supply current	I_{CC}	50	mA
LED output current	I_{LED}	10	mA
REG output current	I_{REG}	0.1	mA
Power dissipation	P_D	350	mW
Operating temperature range	T_{opr}	–20 to 70	°C
Storage temperature range	T_{stg}	–40 to 125	°C

Recommended Operating Conditions

T_a = 25 °C

Parameter	Symbol	Rating	Unit
Supply voltage	V_{CC}	3	V
Supply voltage range	V_{CC}	1.8 to 6.0	V

Electrical Characteristics

Supply current

V_{CC} = 3 V, T_a = 25 °C

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
FM-mode quiescent supply current	$I_{CCQ(FM)}$	No input	–	13	22	mA
AM-mode quiescent supply current	$I_{CCQ(AM)}$	No input	–	5	9	mA

AM characteristics

V_{CC} = 3 V, T_a = 25 °C, f_C = 1 MHz, f_m = 1 kHz

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Detector output voltage	V_O	V_I = 23 dBμ, 30% modulation	16	36	64	mV
		V_I = 80 dBμ, 30% modulation	38	60	95	
Signal-to-noise ratio	S/N	V_I = 23 dBμ, 30% modulation	14	18	–	dB
		V_I = 80 dBμ, 30% modulation	38	46	–	
Total harmonic distortion	THD	V_I = 80 dBμ, 30% modulation	–	0.5	1.3	%
		V_I = 107 dBμ, 30% modulation	–	0.8	3.5	

FM IF amplifier and MPX (mono)

V_{CC} = 3 V, T_a = 25 °C, f_C = 10.7 MHz, f_m = 1 kHz, V_I = 100 dBμ

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
–3 dB limiting sensitivity	–3dBLS	Referenced to V_I = 100 dBμ, 100% modulation, 3 dB down	–	32	41	dBμ
Demodulator output voltage	V_O	100% modulation	80	115	160	mV
Channel balance	CB	100% modulation	–	0	2.0	dB
Total harmonic distortion	THD	100% modulation	–	0.6	1.2	%
Signal-to-noise ratio	S/N	100% modulation	66	71	–	dB

FM IF amplifier and MPX (stereo)

V_{CC} = 3 V, T_a = 25 °C, f_C = 10.7 MHz, f_m = 1 kHz, L + R = 90%, pilot = 10%, V_I = 100 dBμ

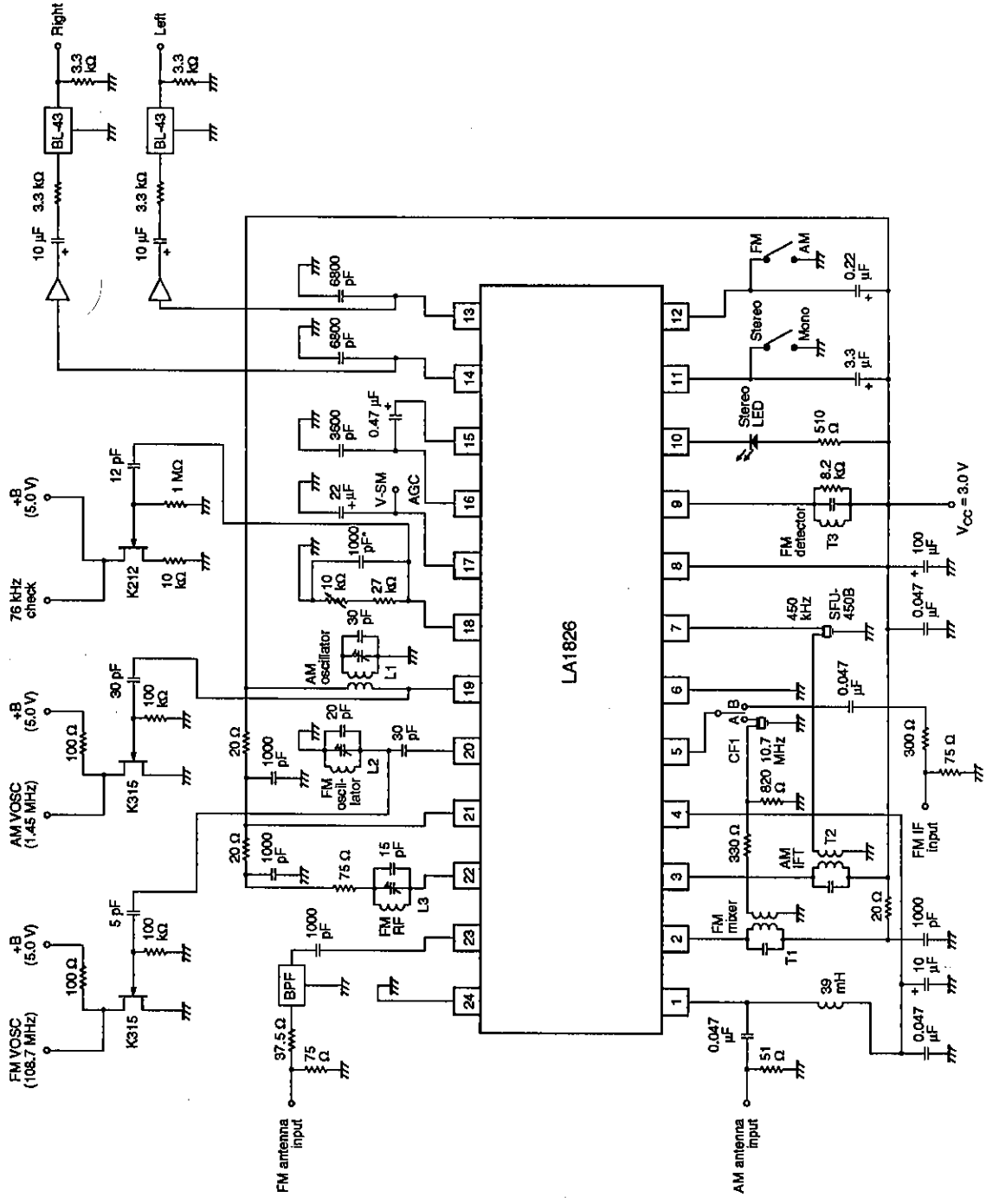
Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Channel separation	Sep		25	35	–	dB
Total harmonic distortion	THD	Main	–	0.5	1.2	%
LED ON sensitivity	V_{LED-ON}	Pilot	1.7	3.5	6.3	%

FM front-end (reference characteristics)

V_{CC} = 3 V, T_a = 25 °C, f_C = 98 MHz, f_m = 1 kHz

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
–3 dB limiting sensitivity	–3dBLS	Referenced to V_I = 80 dBμ, 30% modulation, 3 dB down	–	7	–	dBμ
Oscillator voltage	V_{OSC}	fosc = 108.7 MHz	–	150	–	mV

Measurement Circuit



Note

* Polystyrene film capacitor

COIL SPECIFICATIONS

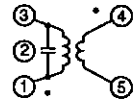
FM

Antenna bandpass filter: Sumida SNY-074-2001

RF: Sumida SA-149 3.6 mm diameter air-core inductor with 4½ turns of 0.6 mm wire

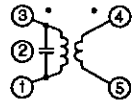
Oscillator: Sumida SA-151 3.6 mm diameter air-core inductor with 3½ turns of 0.6 mm wire

Mixer: Mitsumi YT-30224. When f_o = 10.7 MHz, Q_o = 80 and C = 100 pF.



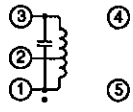
Winding	Turns
1 to 3	8
4 to 6	2

Sumida SA-165. When f_o = 10.7 MHz, $Q_o \geq 50$ and C = 100 pF.



Winding	Turns
3 to 1	2
4 to 6	12

Detector: Sumida SA-179. When f_o = 10.7 MHz, $Q_o \geq 70$ and C = 82 pF.



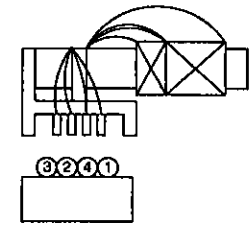
Winding	Turns
1 to 3	10

IF filter: Murata SFE10.7MS2

MW

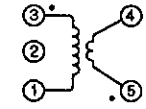
Poly-varicon: Mitsumi PVC-22KTL

Bar antenna: Mitsumi TYA-1005. Pin 1 to pin 2 inductance is 260 µH and Q_o = 360.



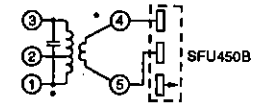
Winding	Turns
1 to 2	68
3 to 4	9

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 = 455 kHz, Q_o = 110 and C = 180 pF (with SFU450B). For the SA-164, when f_o = 450 kHz, $Q_o \geq 65$ and C = 180 pF.



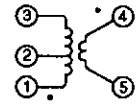
Winding	Turns	
	HW-6215	SA-164
1 to 2	94	122
4 to 6	7	9
2 to 3	58	62

IF filter: Murata SFU-450B

SW

Antenna

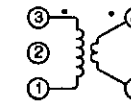
Mitsumi YT-30117. Note that Q_O = 95 and L = 1.4 µH.



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

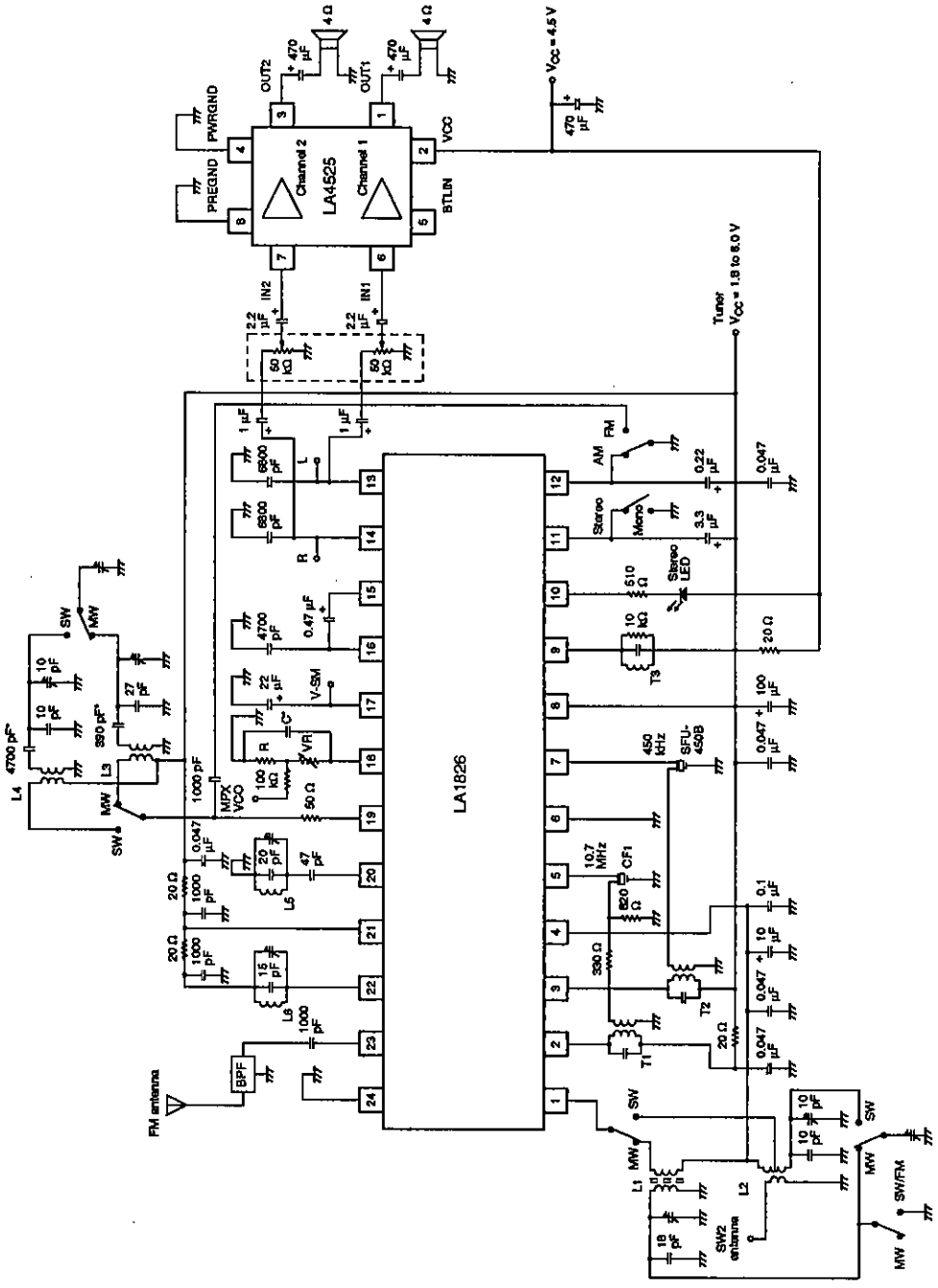
Oscillator

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



Winding	Turns
4 to 6	8
3 to 1	12

TYPICAL APPLICATION



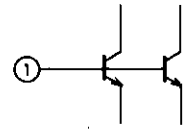
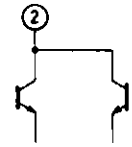
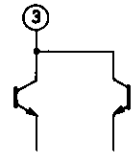
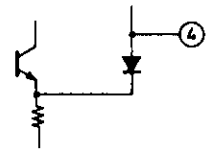
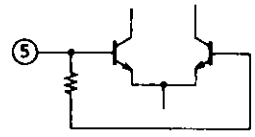
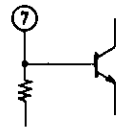
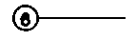
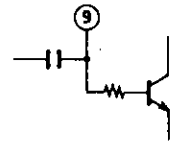
Note

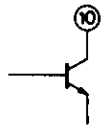
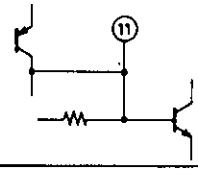
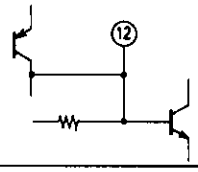
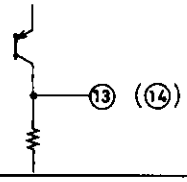
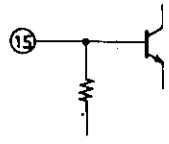
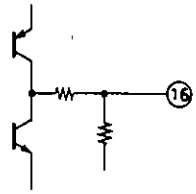
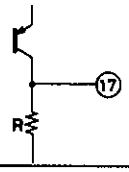
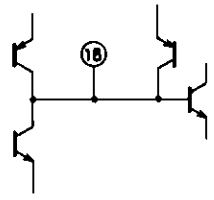
* Polystyrene film capacitor

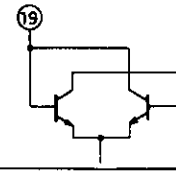
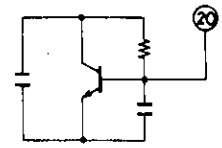
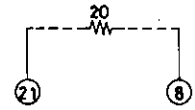
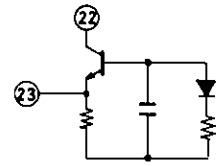
MPX VCO Connection Component Values

Component	Vcc = 3 V	Vcc = 4.5 V	Vcc = 6 V
C	1000 pF	820 pF	620 pF
R	27 kΩ	33 kΩ	51 kΩ
VR	10 kΩ	20 kΩ	30 kΩ

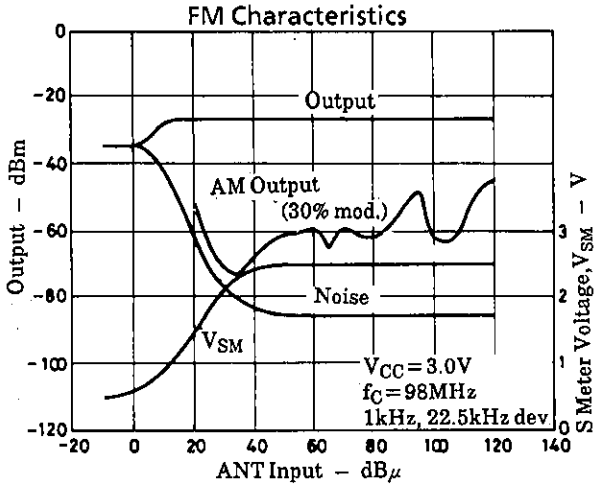
PIN DESCRIPTION

No.	Pin function	Internal equivalent circuit	Description	Quiescent voltage V_{CC}=3.0 V [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

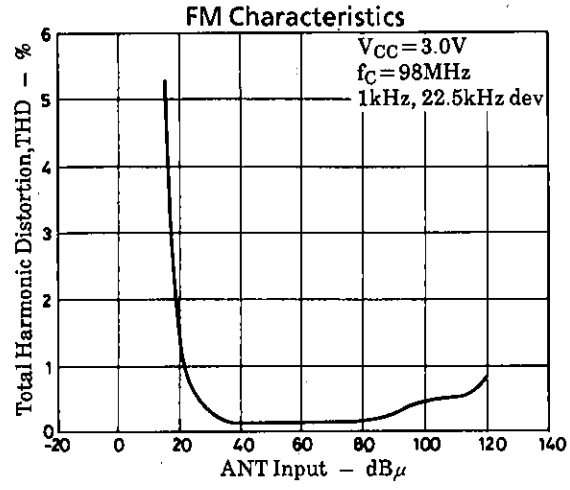
No.	Pin function	Internal equivalent circuit	Description	Quiescent voltage V_{CC} = 3.0 V [V]	
				AM	FM
10	Stereo LED		Active-Low open collector	3.0	3.0
11	Pilot detector		Forced monaural mode when pin 11 is connected to ground	1.7	2.3
12	Phase detector		FM when pin 12 is open, and AM when connected 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 output 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

No.	Pin function	Internal equivalent circuit	Description	Quiescent voltage V_{CC}=3.0 V [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	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) r_i=430 Ω input impedance	3.0	2.8
23	FM RF input				
24	FM front-end ground			0	0

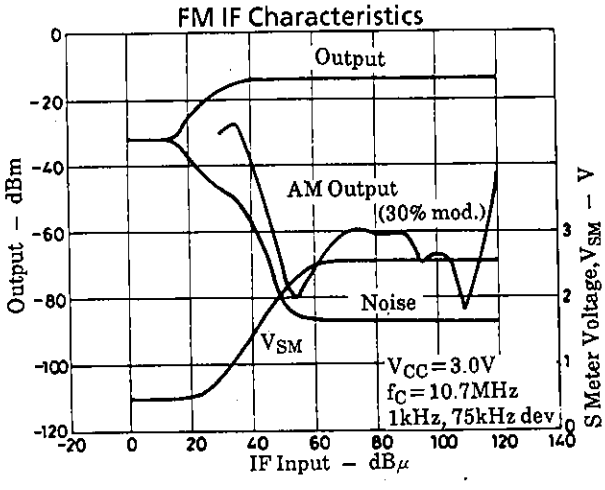
FM Characteristics



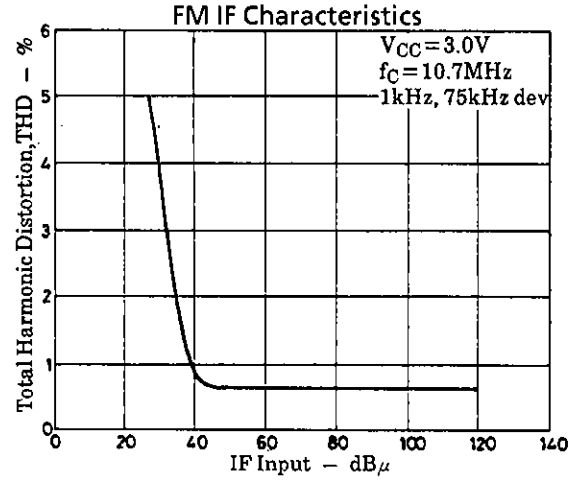
FM Characteristics



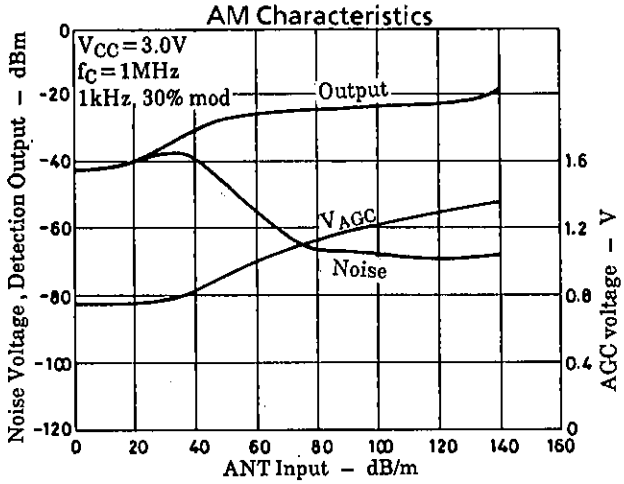
FM IF Characteristics



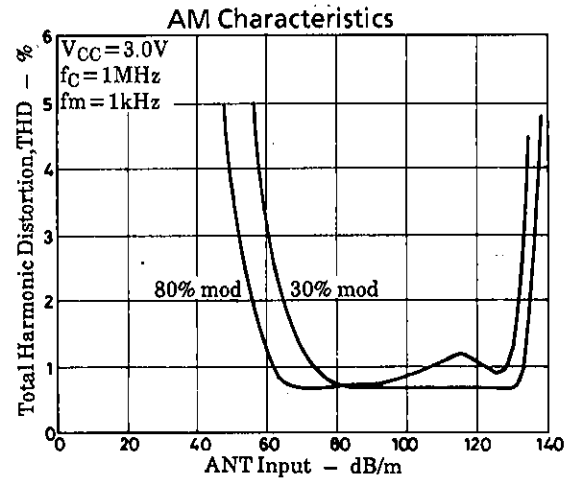
FM IF Characteristics



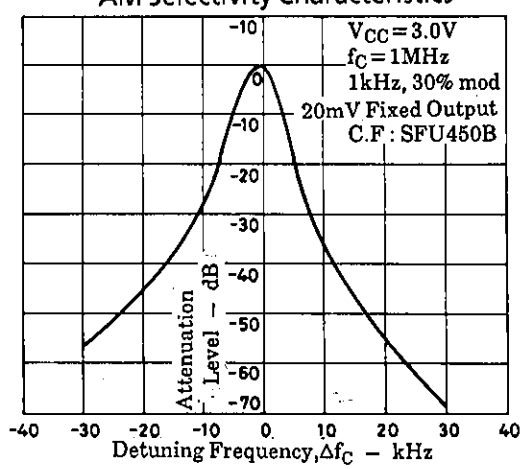
AM Characteristics



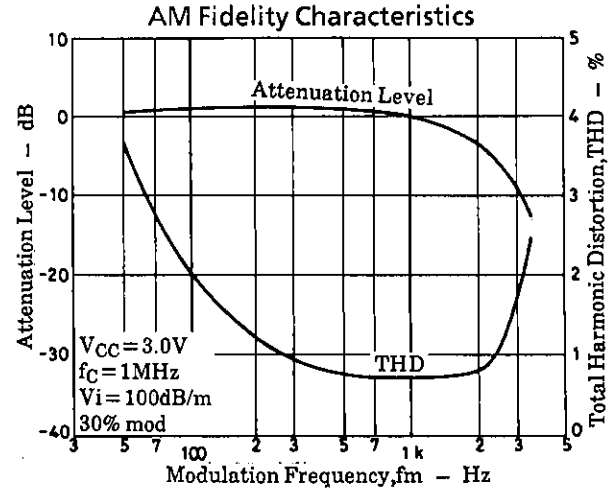
AM Characteristics



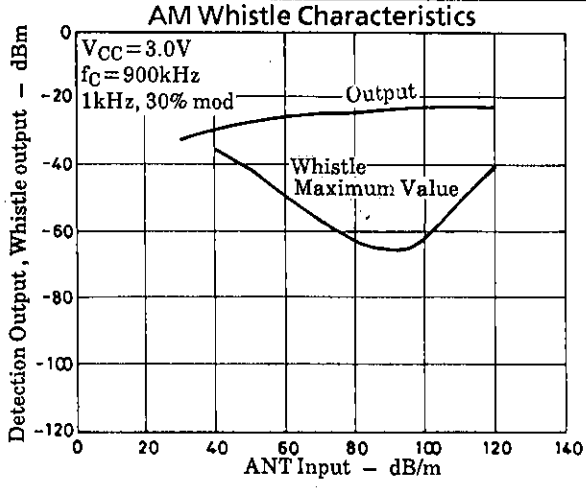
AM Selectivity Characteristics



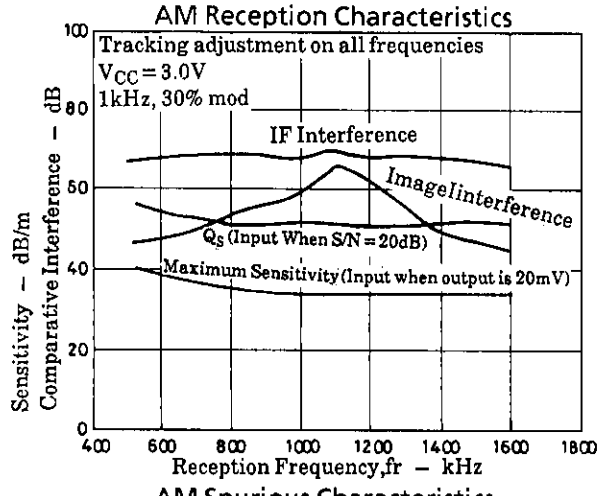
AM Fidelity Characteristics



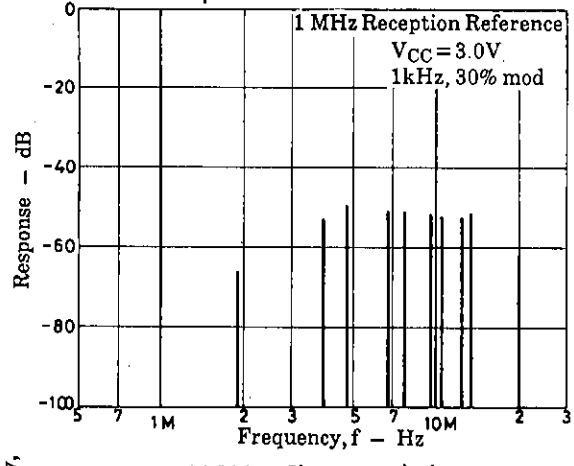
AM Whistle Characteristics



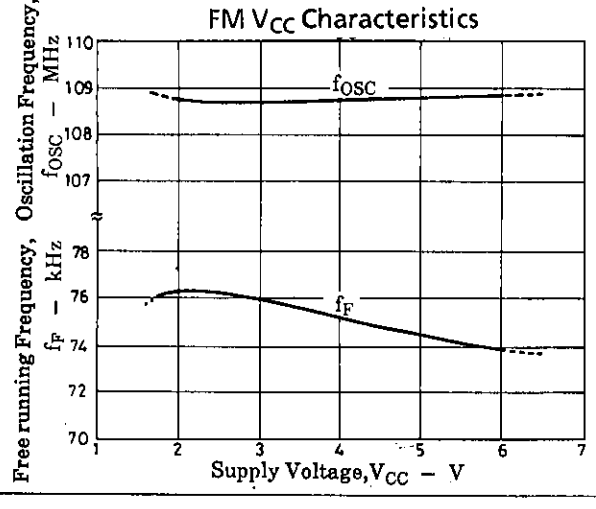
AM Reception Characteristics



AM Spurious Characteristics



FM V_{CC} Characteristics



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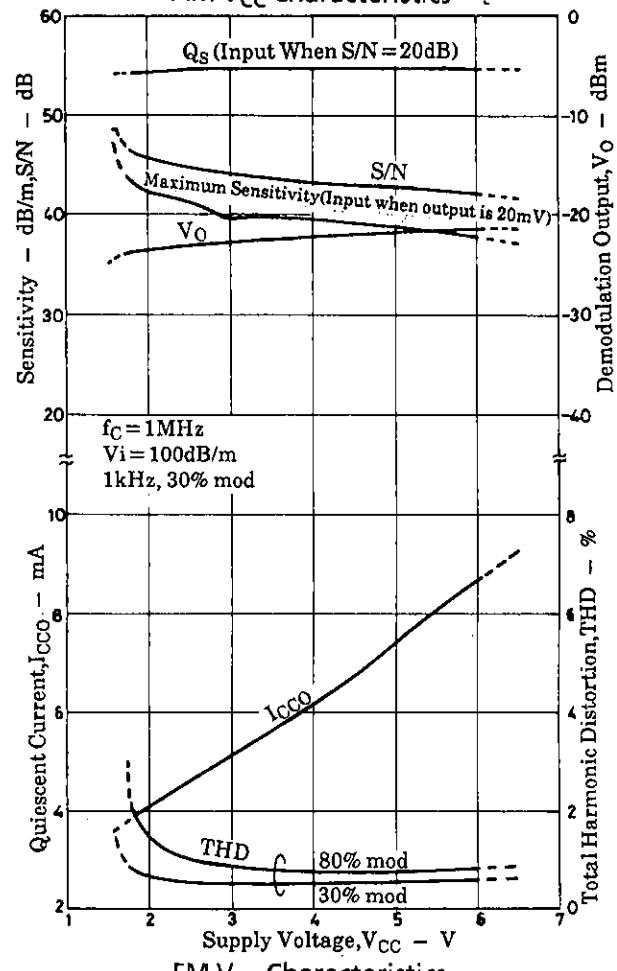
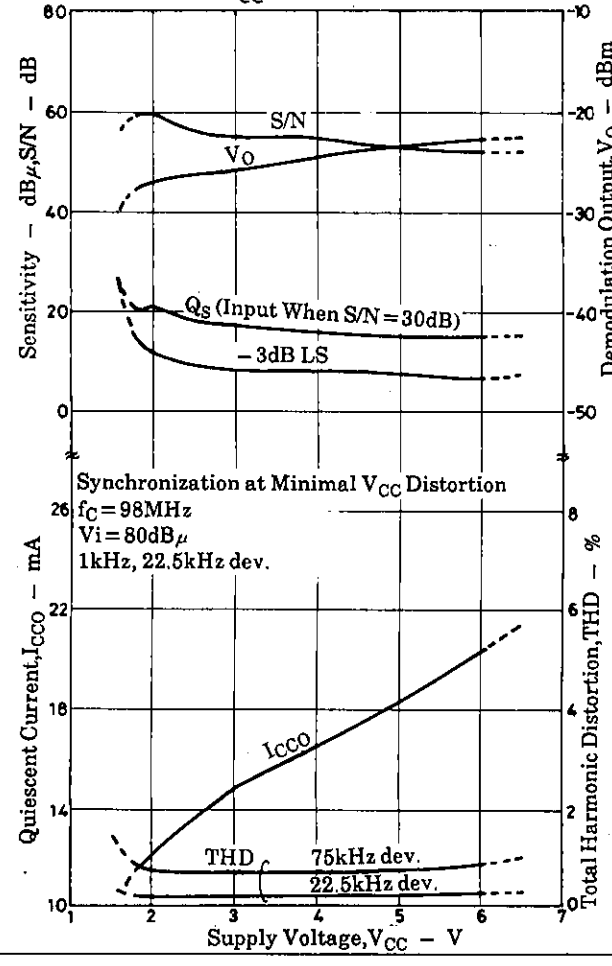
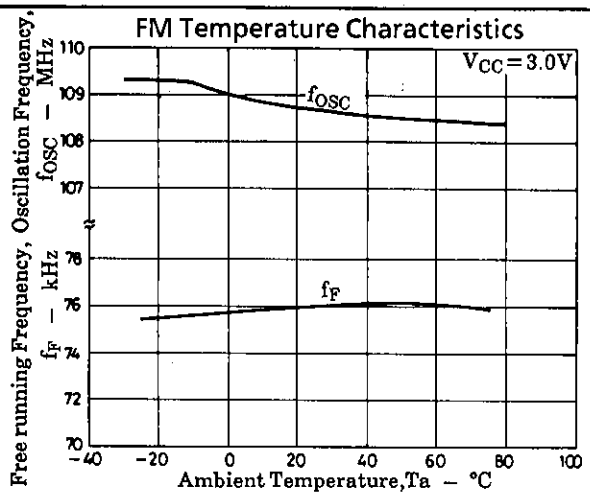


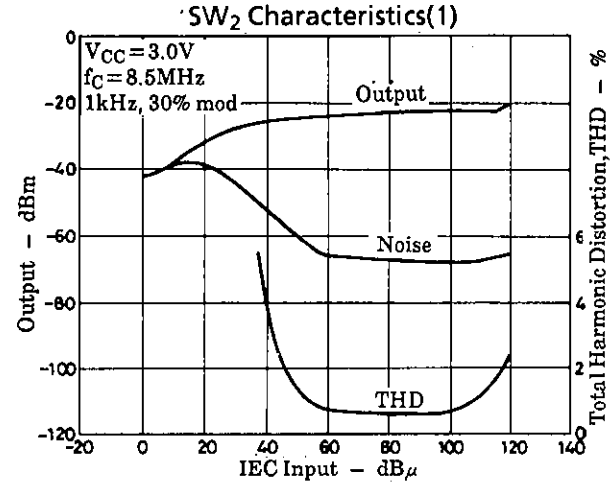
FM V_{CC} Characteristics



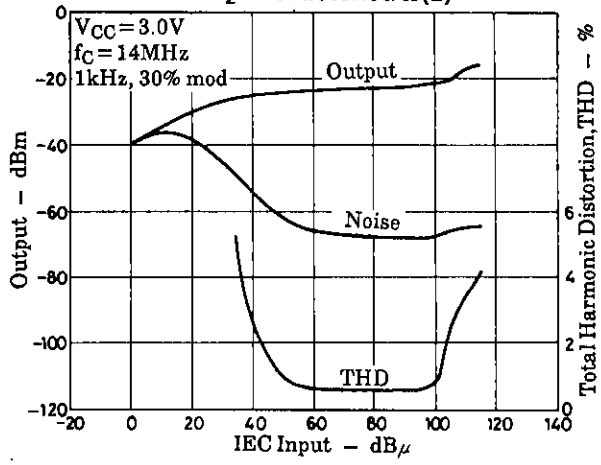
FM Temperature Characteristics



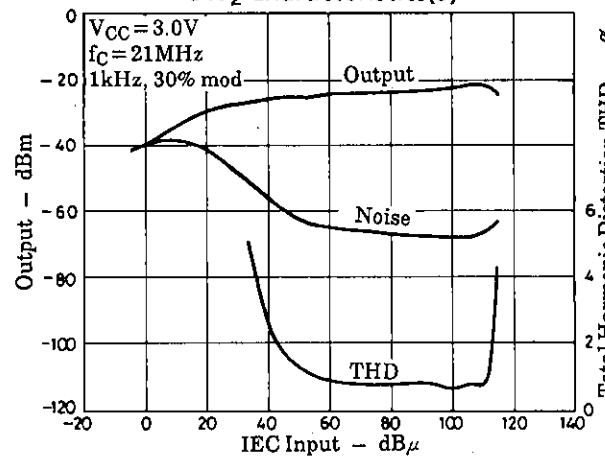
SW_2 Characteristics(1)



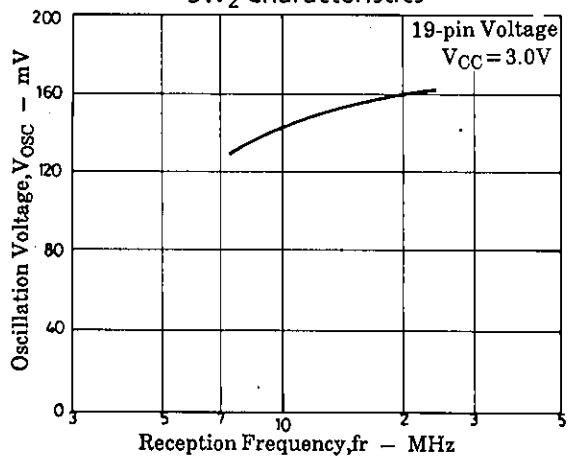
SW_2 Characteristics(2)



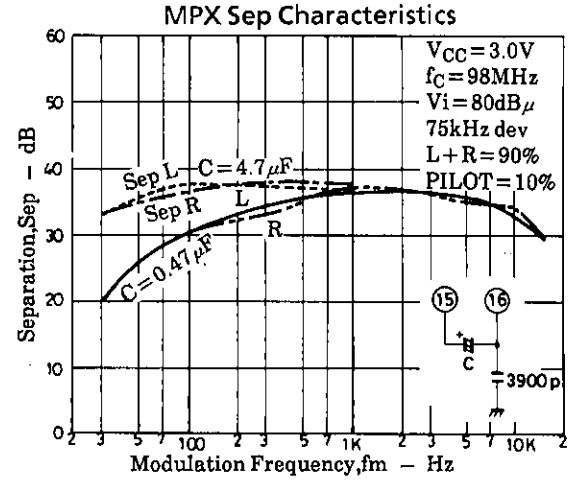
SW_2 Characteristics(3)



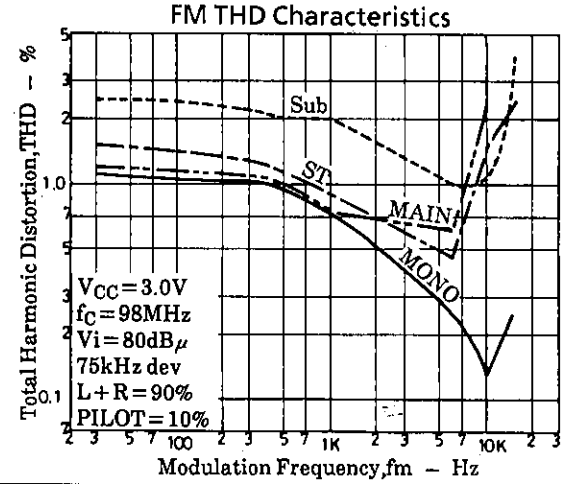
SW_2 Characteristics



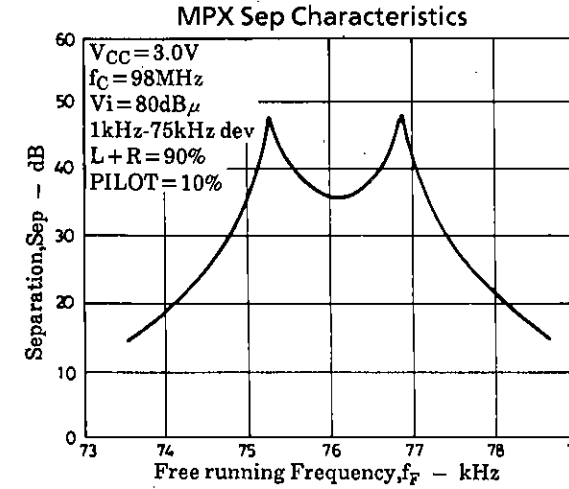
MPX Sep Characteristics



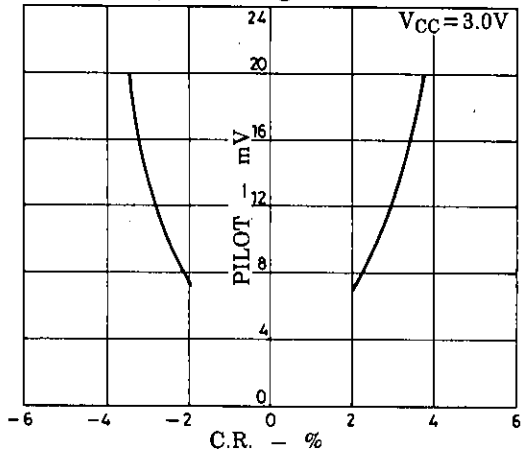
FM THD Characteristics



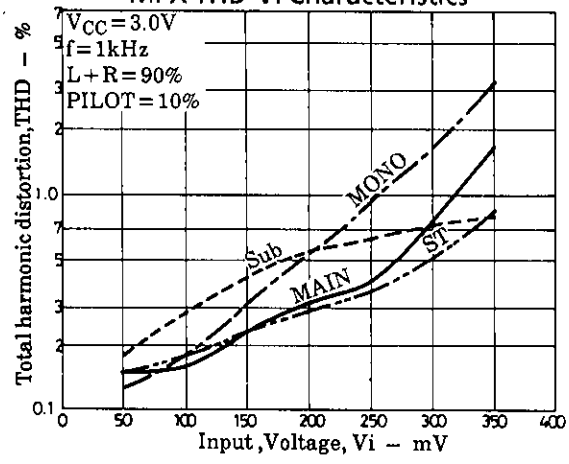
MPX Sep Characteristics



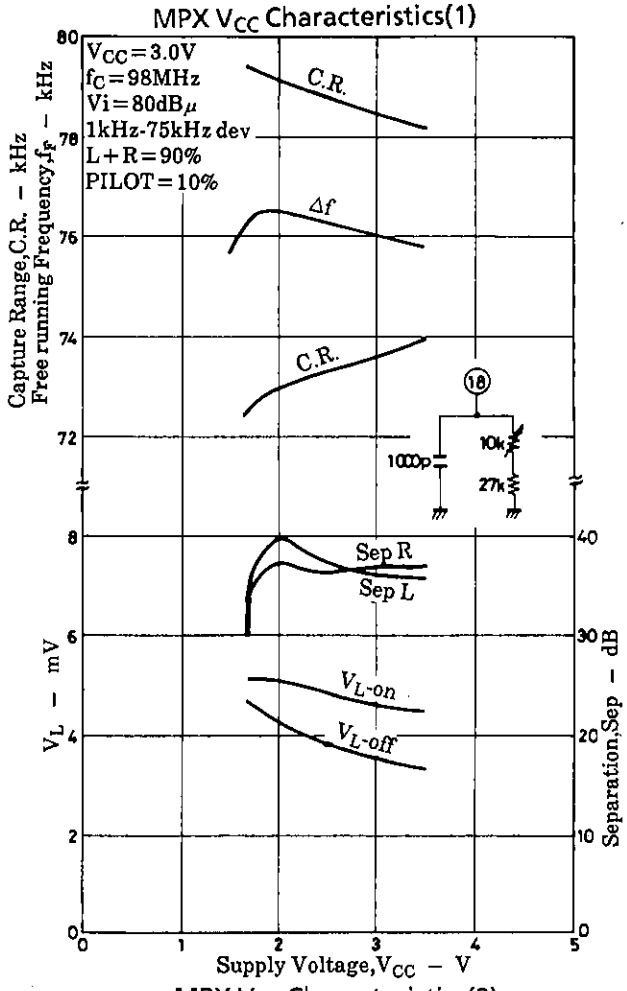
MPX Capture Range Characteristics



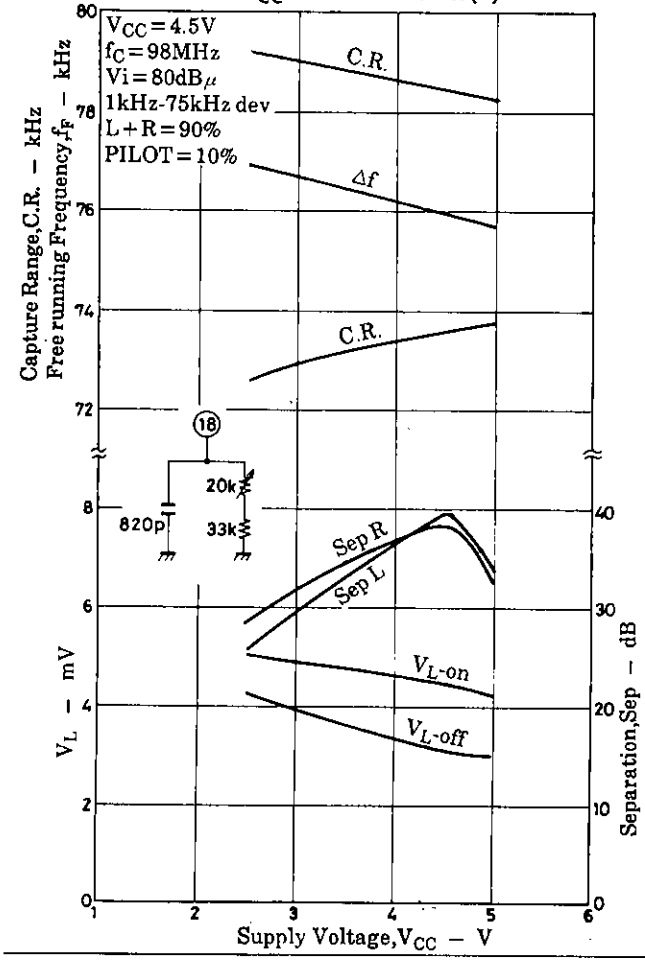
MPX THD-Vi Characteristics



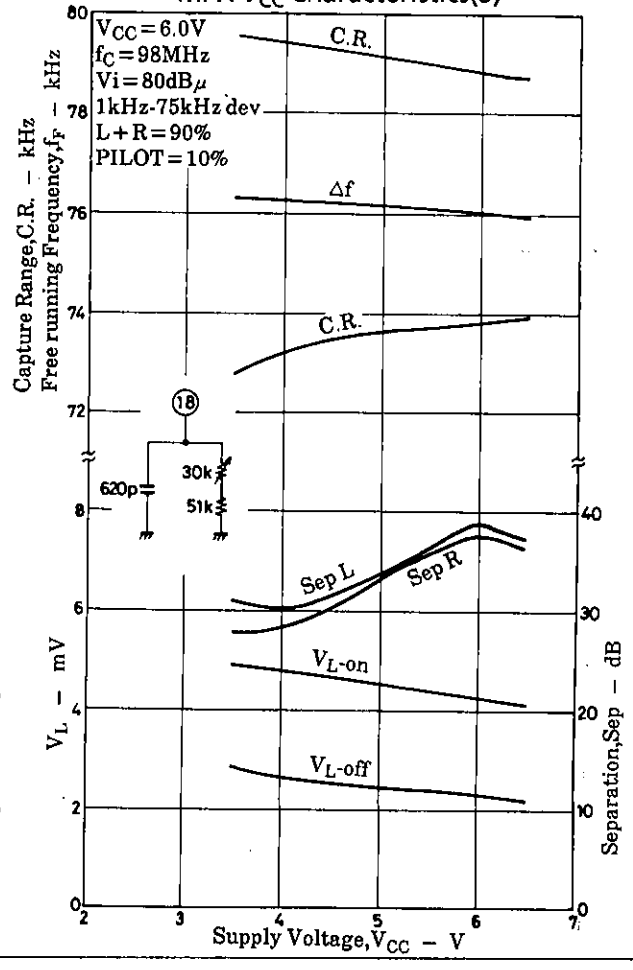
MPX V_{CC} Characteristics(1)



MPX V_{CC} Characteristics(2)



MPX V_{CC} Characteristics(3)



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