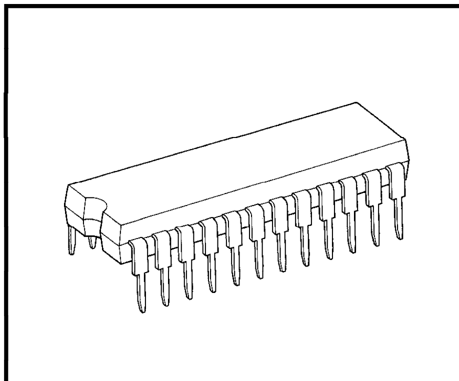
TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT

TA8167N

SILICON MONOLITHIC

3V AM / FM 1CHP TUNER IC

TA8167N is the AM / FM 1chip tuner IC, which is designed for Portable radios and 3V Headphone radios.



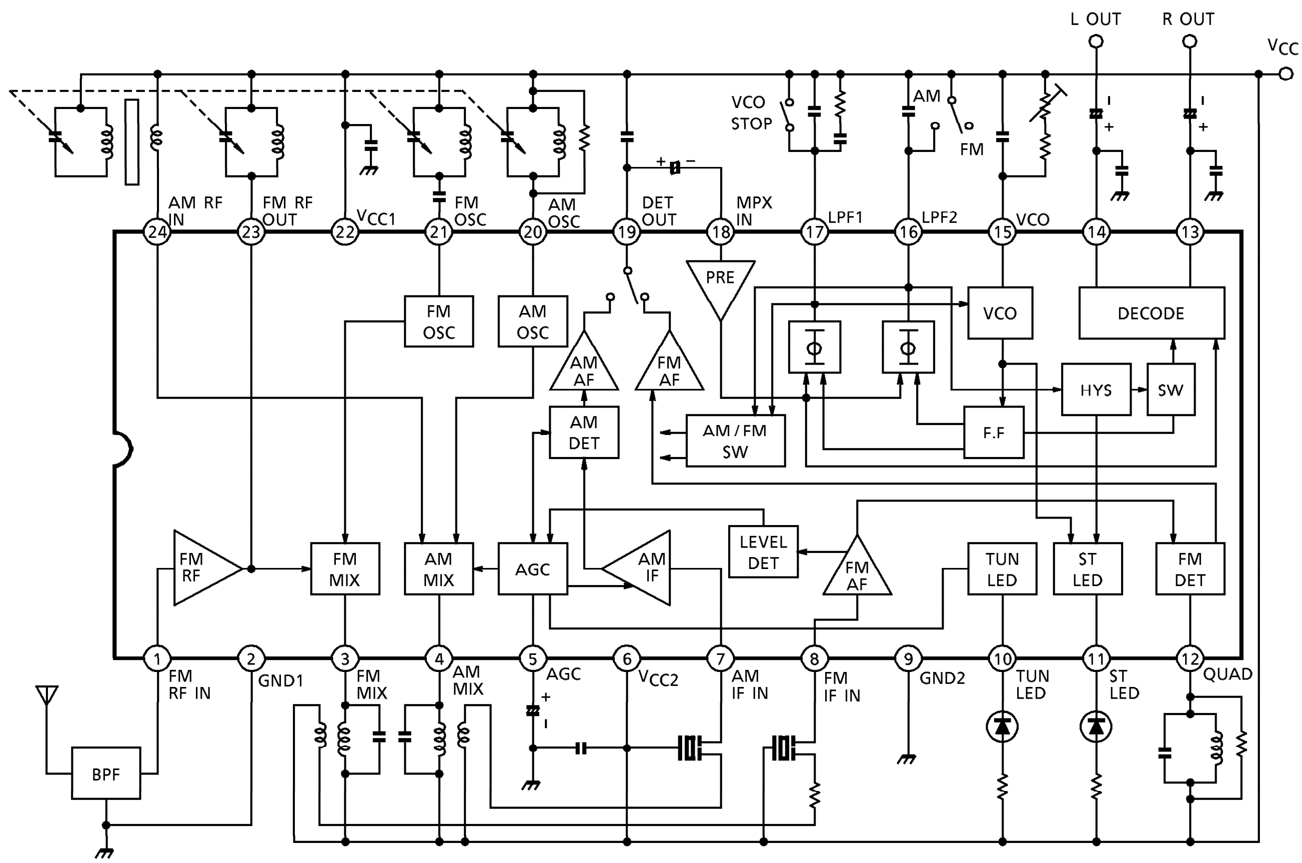
SDIP24-P-300

Weight : 1.2g (Typ.)

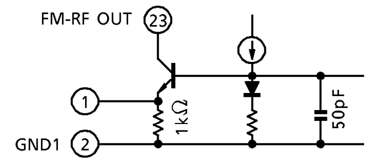
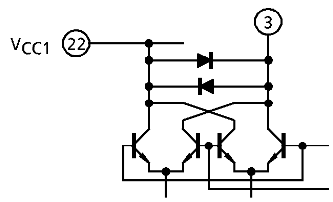
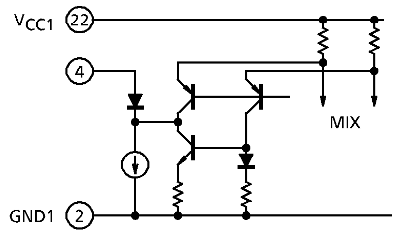
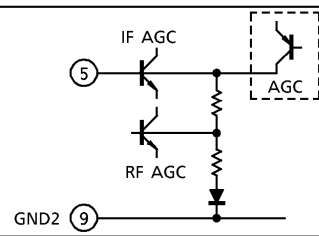
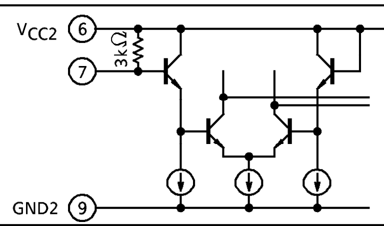
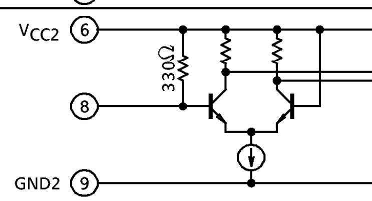
FEATURES

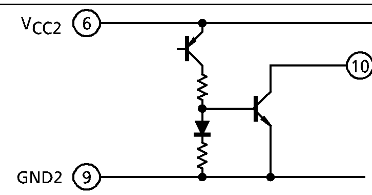
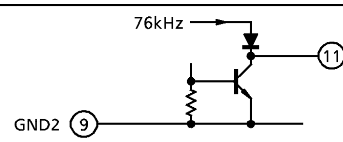
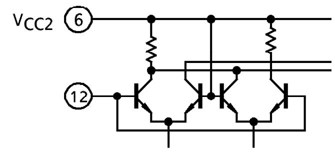
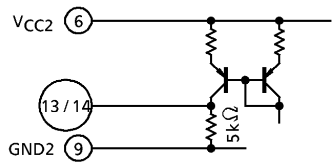
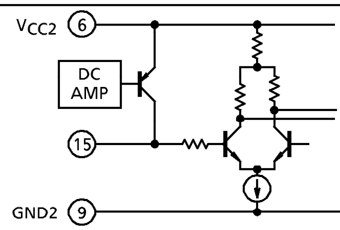
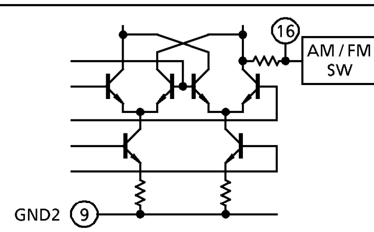
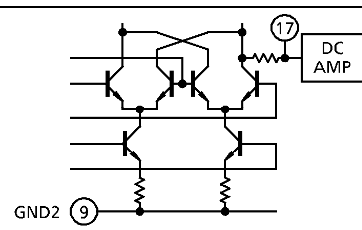
- Built-in
  FM F / E, AM / FM IF and FM MPX
- AM Detector Coil and IF Coupling Condenser are not needed.
- S curve characteristics of FM detection output is Reverse characteristic.
- The FM Local Oscillation Voltage is set up low relatively for measures against FM radiation.
- Operating Supply Voltage Range
  V_{CC} = 1.8~7.0V (Ta = 25°C)

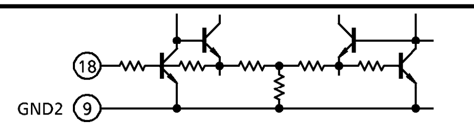
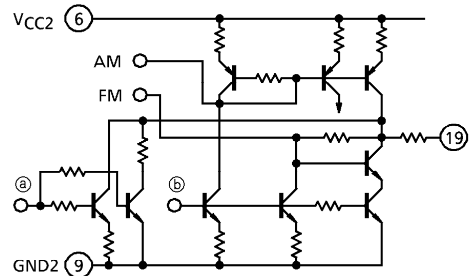
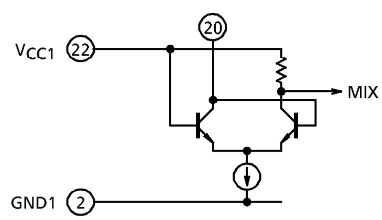
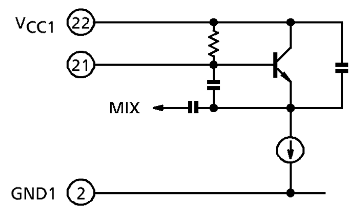
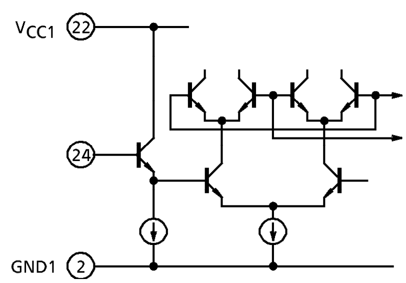
BLOCK DIAGRAM



EXPLANATION OF TERMINALS

PIN No.	SYMBOL	INTERNAL CIRCUIT	DC VOLTAGE (V) (AT NO SIGNAL)	
			AM	FM
1	FM-RF IN		0	0.7
2	GND1 (GND for RF Stage)	—	0	0
3	FM MIX		3.0	3.0
4	AM MIX		3.0	3.0
5	AGC (AM AGC)		0	0
6	V_{CC2} (V_{CC} for IF / MPX Stage)	—	3.0	3.0
7	AM IF IN		3.0	3.0
8	FM IF IN		3.0	3.0

PIN No.	SYMBOL	INTERNAL CIRCUIT	DC VOLTAGE (V) (AT NO SIGNAL)	
			AM	FM
9	GND2 (GND for IF / MPX Stage)	—	0	0
10	TUN LED (Tuning LED)		—	—
11	ST LED (Stereo LED)		—	—
12	QUAD (FM QUAD, Detector)		3.0	3.0
13 14	R-OUT (R-ch Output) L-OUT (L-ch Output)		1.0	1.0
15	VCO		2.5	2.5 (VCO STOP MODE)
16	LPF2 • LPF Terminal for Synchronous Detector • Bias Terminal for AM / FM SW Circuit $V_{16} = V_{CC}$ →AM (VCO Stop) V_{16} = Open →FM		3.0	2.2 (VCO STOP MODE 2.7)
17	LPF1 • LPF Terminal for Phase Detector • VCO Stop Terminal $V_{17} = V_{CC}$→VCO Stop		2.7	2.2

PIN No.	SYMBOL	INTERNAL CIRCUIT	DC VOLTAGE (V) (AT NO SIGNAL)	
			AM	FM
18	MPX IN		0.7	0.7
19	DET OUT	 ⓐ LOW→FM, HIGH→AM ⓑ LOW→AM, HIGH→FM	1.5	1.2
20	AM OSC		3.0	3.0
21	FM OSC		3.0	3.0
22	V_{CCL} (V_{CC} for RF Stage)	—	3.0	3.0
23	FM RF OUT	cf. pin①	3.0	3.0
24	AM RF IN		3.0	3.0

MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage	V_{CC}	8	V
LED Current	I_{LED}	10	mA
LED Voltage	V_{LED}	8	V
Power Dissipation	P_D (Note)	1200	mW
Operating Temperature	T_{opr}	−25~75	°C
Storage Temperature	T_{stg}	−55~150	°C

(Note) Derated above Ta = 25°C in the proportion of 9.6mW / °C.

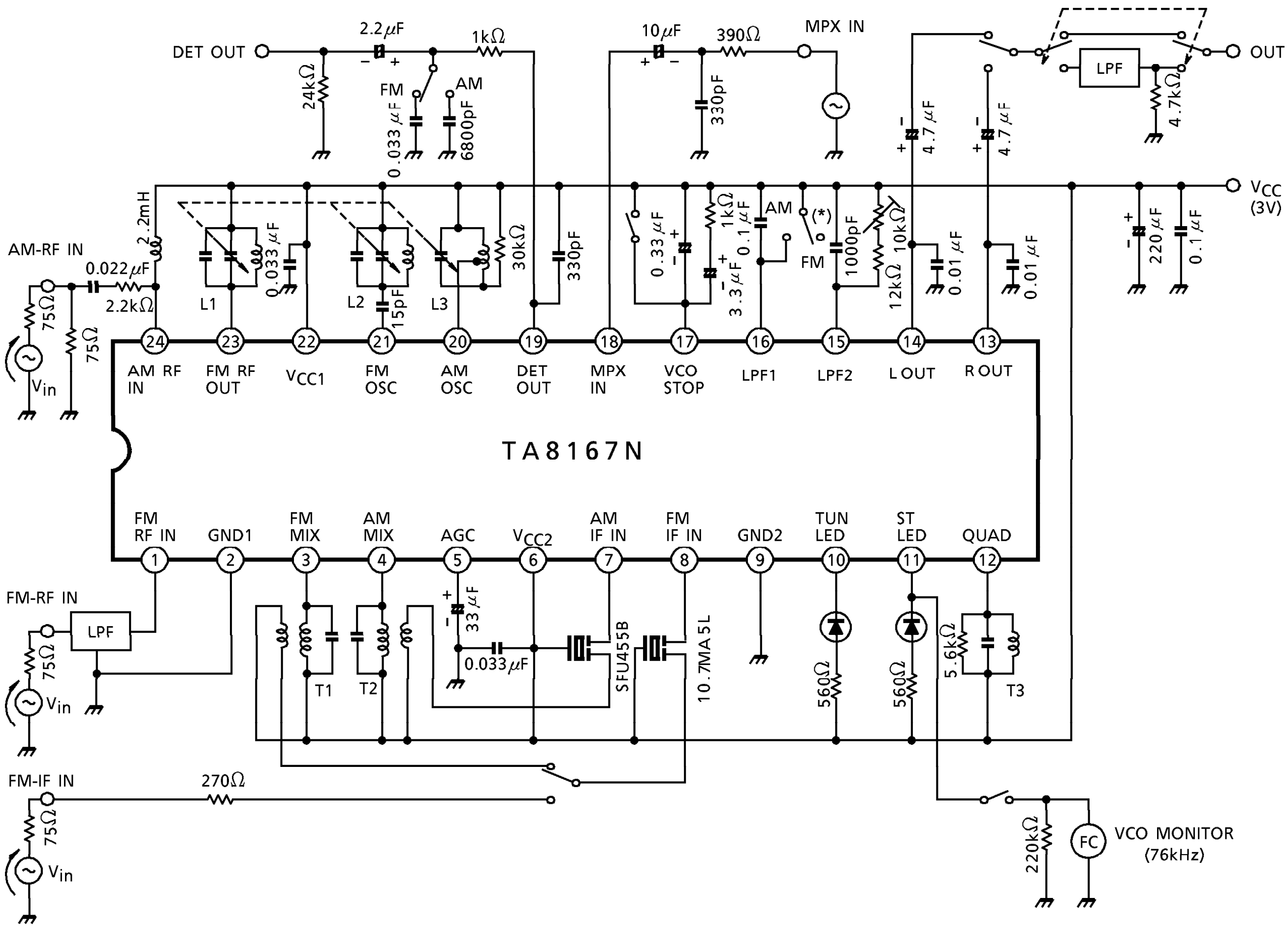
ELECTRICAL CHARACTERISTICS

Unless otherwise specified, Ta = 25°C, V_{CC} = 3V,
F / E : f = 83MHz, f_m = 1kHz
FM IF : f = 10.7MHz, Δf = ±22.5kHz, f_m = 1kHz
AM : f = 1MHz, MOD = 30%, f_m = 1kHz
MPX : f_m = 1kHz

CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Current		I_{CC} (FM)	1	V_{in} = 0, FM Mode	—	13.2	20.0	mA
		I_{CC} (AM)	1	V_{in} = 0, AM Mode	—	8.4	13.5	
F / E	Input Limiting Voltage	V_{in} (lim)	1	−3dB Limiting	—	10.0	—	dBμV EMF
	Local OSC Voltage	V_{OSC}	2	f_{OSC} = 72.3MHz	—	70	—	mV_{rms}
FM IF	Input Limiting Voltage	V_{in} (lim) IF	1	−3dB Limiting	40	46	53	dBμV EMF
	Recovered Output Voltage	V_{OD}	1	V_{in} = 80dBμV EMF	55	80	110	mV_{rms}
	Signal To Noise Ratio	S / N	1	V_{in} = 80dBμV EMF	—	70	—	dB
	Total Harmonic Distortion	THD	1	V_{in} = 80dBμV EMF	—	0.4	—	%
	AM Rejection Ratio	AMR	1	V_{in} = 80dBμV EMF	—	32	—	dB
	Lamp ON sensitivity	V_L	1	I_L = 1mA	45	51	56	dBμV EMF
AM	Gain	G_V	1	V_{in} = 26dBμV EMF	40	70	110	mV_{rms}
	Recovered Output Voltage	V_{OD}	1	V_{in} = 60dBμV EMF	55	80	110	mV_{rms}
	Signal To Noise Ratio	S / N	1	V_{in} = 60dBμV EMF	—	42	—	dB
	Total Harmonic Distortion	THD	1	V_{in} = 60dBμV EMF	—	1.0	—	%
	Lamp ON Sensitivity	V_L	1	I_L = 1mA	20	25	30	dBμV EMF
Pin⑲ Output Resistance		R_{19}	—	FM Mode	—	0.75	—	kΩ
				AM Mode	—	12.5	—	

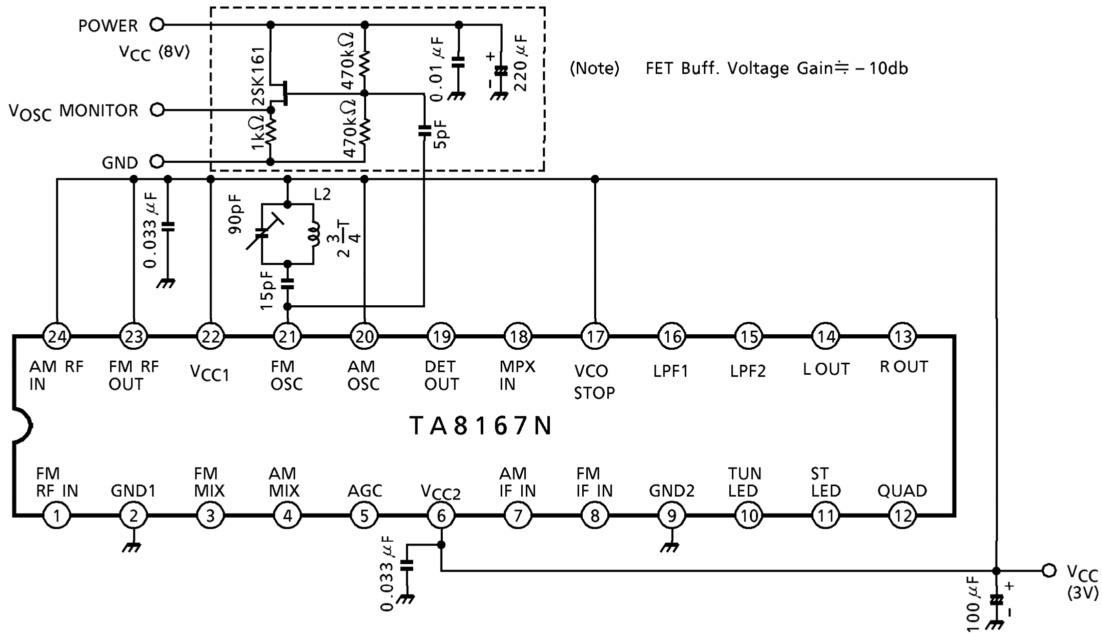
CHARACTERISTIC			SYMBOL	TEST CIRCUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
MPX	Input Resistance		R_{IN}	—	—		—	24	—	kΩ
	Output Resistance		R_{OUT}	—	—		—	5	—	kΩ
	Max. Composite Signal Input Voltage		V_{in} max (STEREO)	1	L + R = 90%, P = 10%, f_m = 1kHz, THD = 3%		—	350	—	mV_{rms}
	Separation		Sep	1	L + R = 135mV_{rms} P = 15mV_{rms}	f_m = 100Hz	—	42	—	dB
						f_m = 1kHz	35	42	—	
						f_m = 10kHz	—	42	—	
	Total Harmonic Distortion	Monaural	THD (MONAURAL)	1	V_{in} = 150mV_{rms}		—	0.2	—	%
		Stereo	THD (STEREO)		L + R = 135mV_{rms}, P = 15mV_{rms}		—	0.2	—	
	Voltage Gain		G_V (MPX)	1	V_{in} = 150mV_{rms}		−5	−3	−1	dB
	Channel Balance		C.B.	1	V_{in} = 150mV_{rms}		−2	0	2	dB
	Stereo Lamp Sensitivity	ON	$V_{L (ON)}$	1	Pilot Input		—	8	16	mV_{rms}
		OFF	$V_{L (OFF)}$				2	6	—	
	Stereo Lamp Hysteresis		V_H	1	To LED turn off from LED turn on		—	2	—	mV_{rms}
	Capture Range		C.R.	1	P = 15mV_{rms}		—	±3	—	%
	Signal To Noise Ratio		S / N	1	—		—	70	—	dB

TEST CIRCUIT 1



(*) POLYESTER FILM CONDENSER
Using other types of condensers, there are some cases that the MPX does not do normal stereo action at high temperature or low temperature.

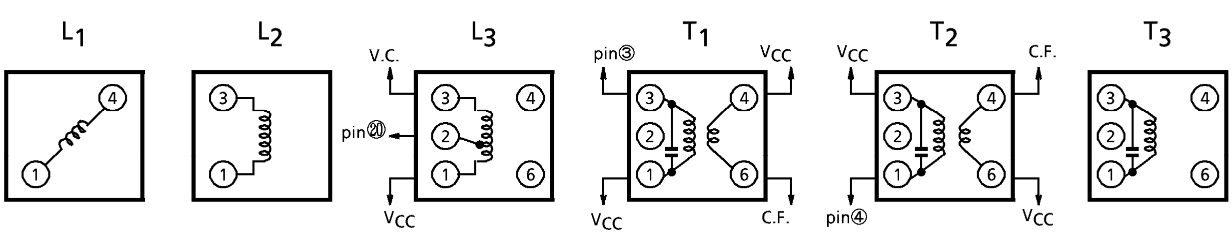
TEST CIRCUIT 2



COIL DATA

COIL No.	TEST FREQ. (Hz)	L (μH)	C_o (pF)	Q_o	TURNS					WIRE (mmϕ)	REFERENCE
					1-2	2-3	1-3	1-4	4-6		
L_1 FM RF	100M	—	—	100	—	—	—	$2\frac{1}{2}$	—	0.5UEW	Ⓢ 53T-037-202
L_2 FM OSC	100M	—	—	100	—	—	$2\frac{3}{4}$	—	—	0.5UEW	Ⓢ 0258-244
L_3 AM OSC	796k	288	—	115	13	73	—	—	—	0.08UEW	Ⓢ 4147-1356-038
T_1 FM MIX	10.7M	—	75	100	—	—	13	—	2	0.1UEW	Ⓢ 2153-414-041
T_2 AM MIX	455k	—	180	120	—	—	180	—	15	0.08UEW	Ⓢ 2150-2162-165
T_3 FM DET	10.7M	—	47	165	—	—	16	—	—	0.09UEW	Ⓢ 2153-4095-122

Ⓢ : SUMIDA ELECTRIC CO., LTD



HINT ON USE OF TA8167N

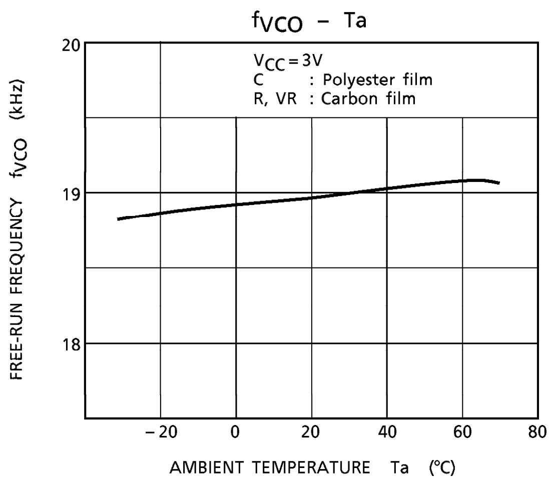
○ External parts of MPX VCO

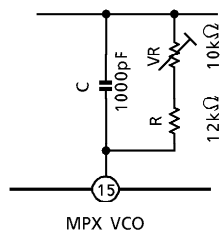
(1) Temperature characteristic of MPX VCO free-run frequency.

The temperature characteristic of MPX VCO is shown in the diagram as below.

Select one with a better temperature characteristic (C, R and VR.) in use. We recommend,

C : POLYESTER FILM
R, VR.: CARBON FILM





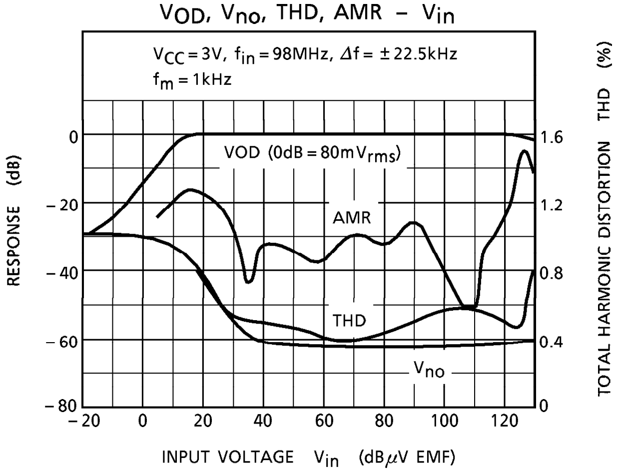
(2) Value of the external parts

We recommend to set up these value as below.

C = 1000pF
R = 12kΩ
VR = 10kΩ

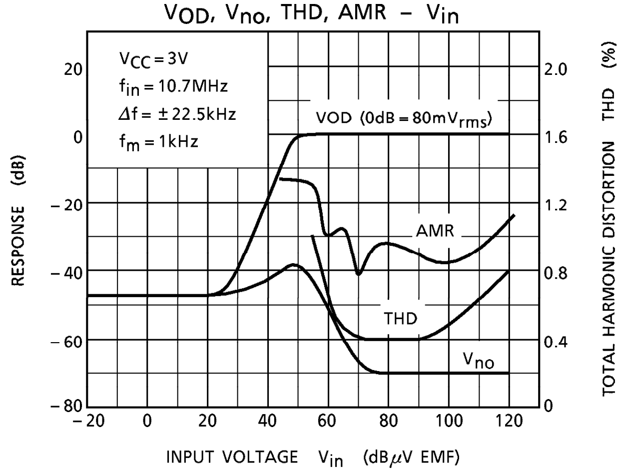
FM (F / E + IF)

V_{OD}, V_{no}, THD, AMR – V_{in}



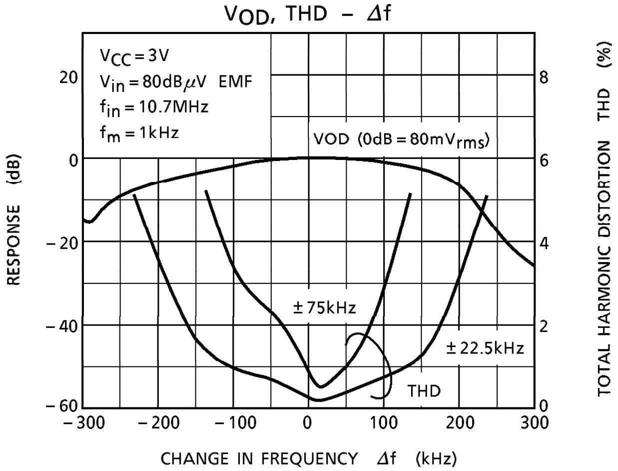
FM (IF)

V_{OD}, V_{no}, THD, AMR – V_{in}



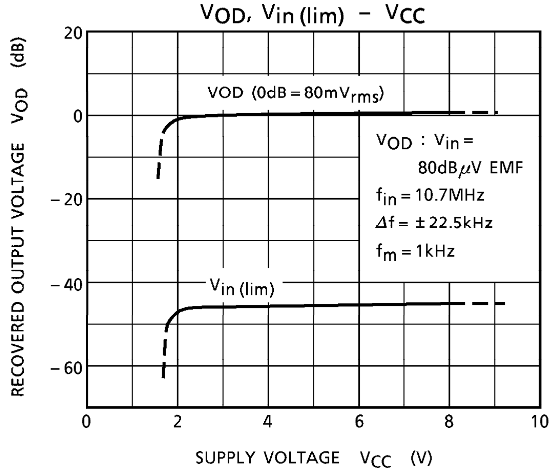
FM (IF)

V_{OD}, THD – Δf



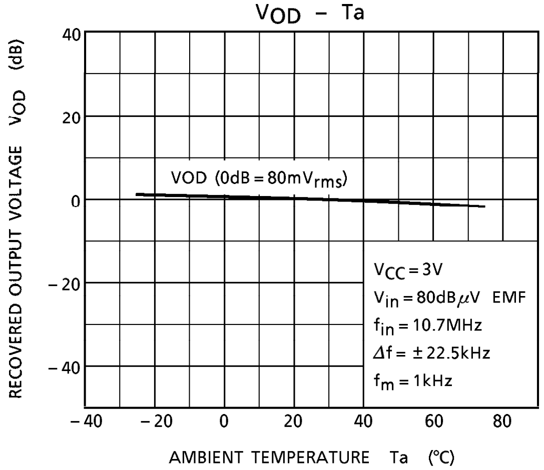
FM (IF)

V_{OD}, $V_{in (lim)}$ – V_{CC}



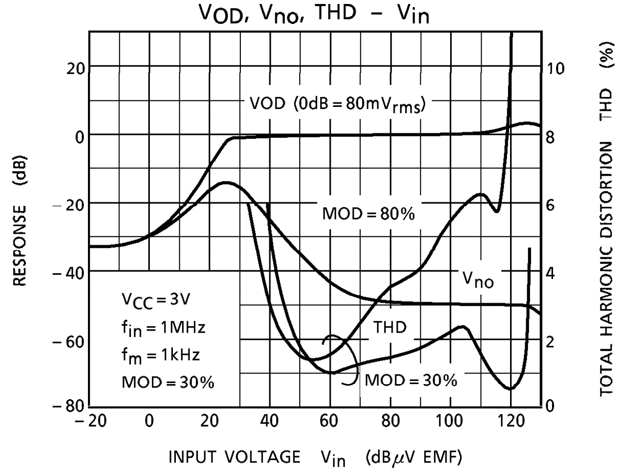
FM (IF)

V_{OD} – Ta

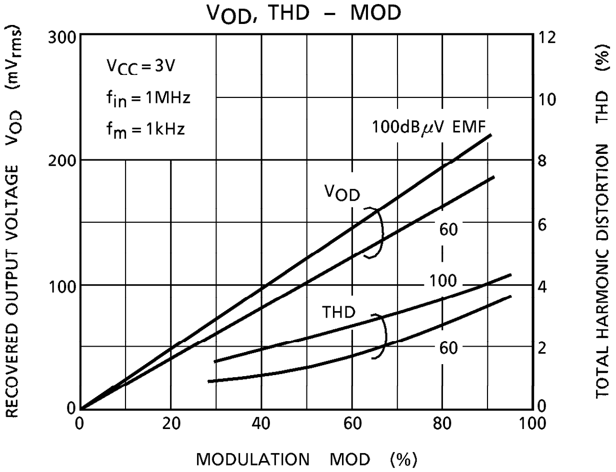


AM

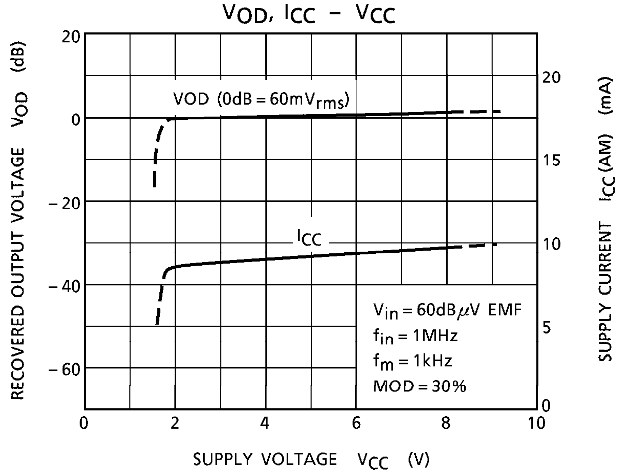
V_{OD}, V_{no}, THD – V_{in}



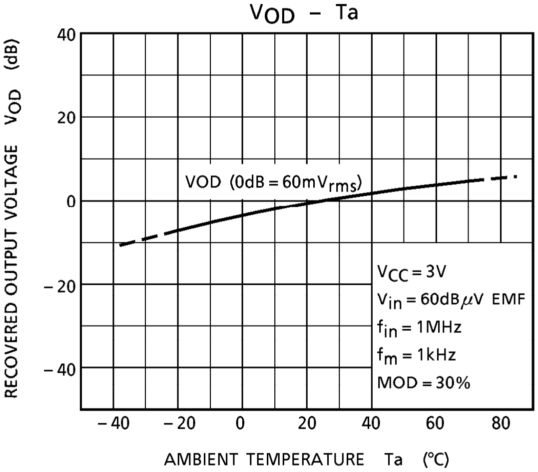
V_{OD}, THD – MOD



V_{OD}, I_{CC} – V_{CC}

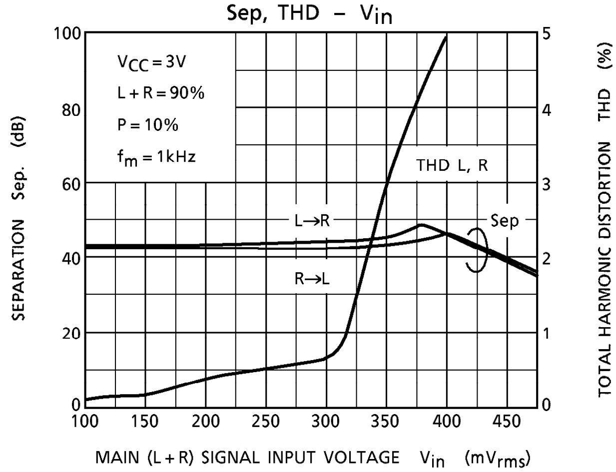


V_{OD} – Ta

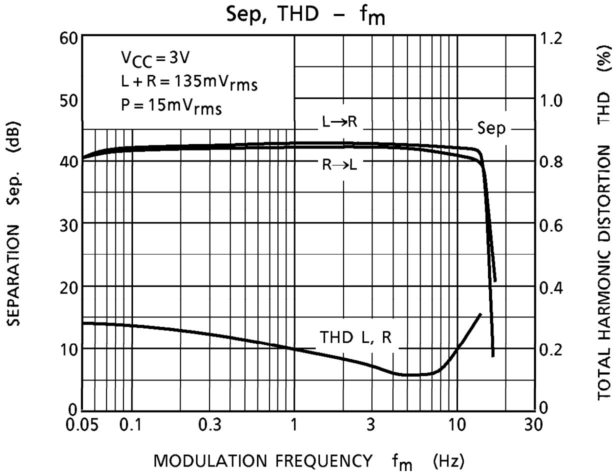


MPX

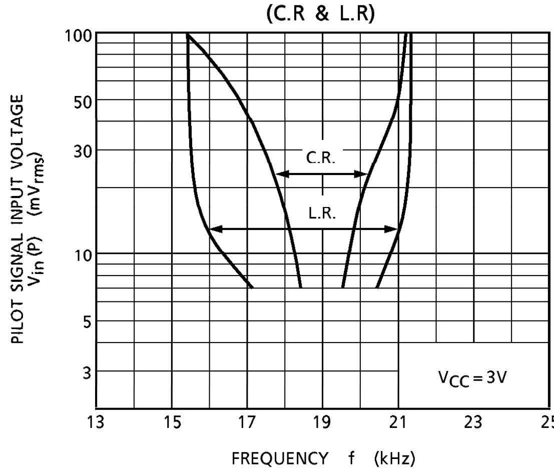
Sep, THD – V_{in}

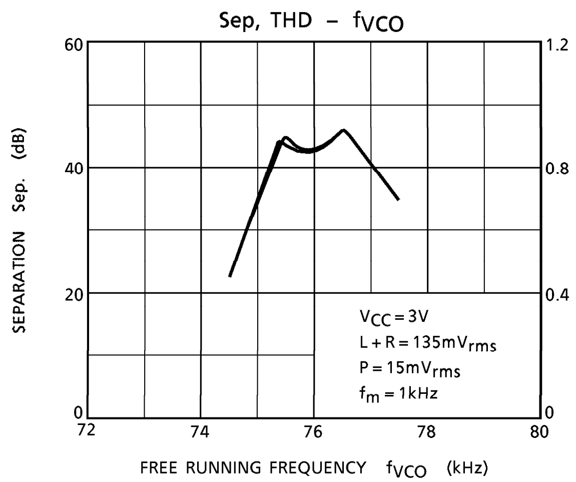


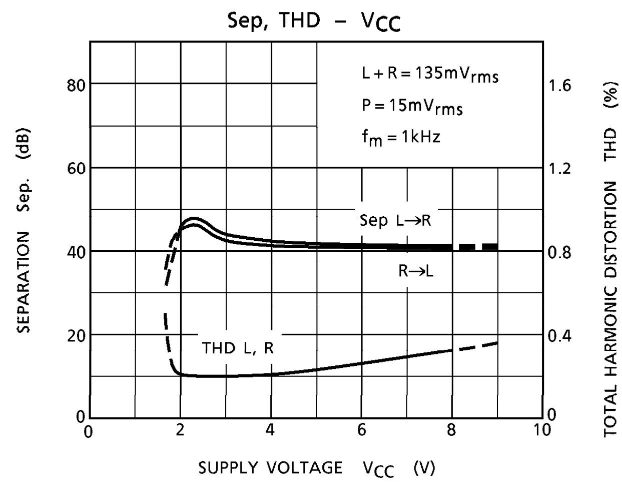
Sep, THD – f_m

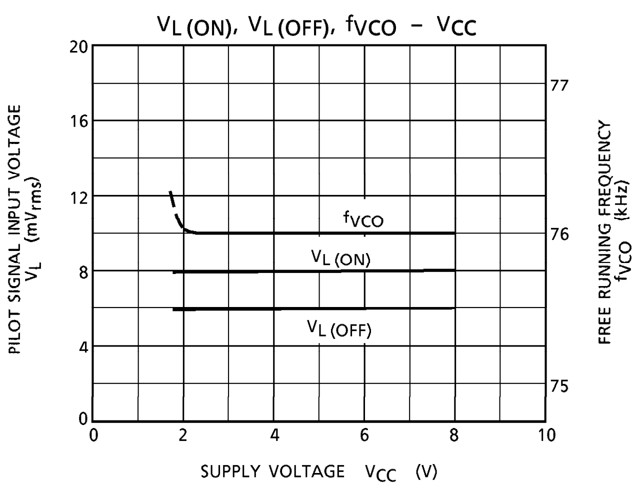


CAPTURE RANGE & LOCK RANGE (C.R & L.R)



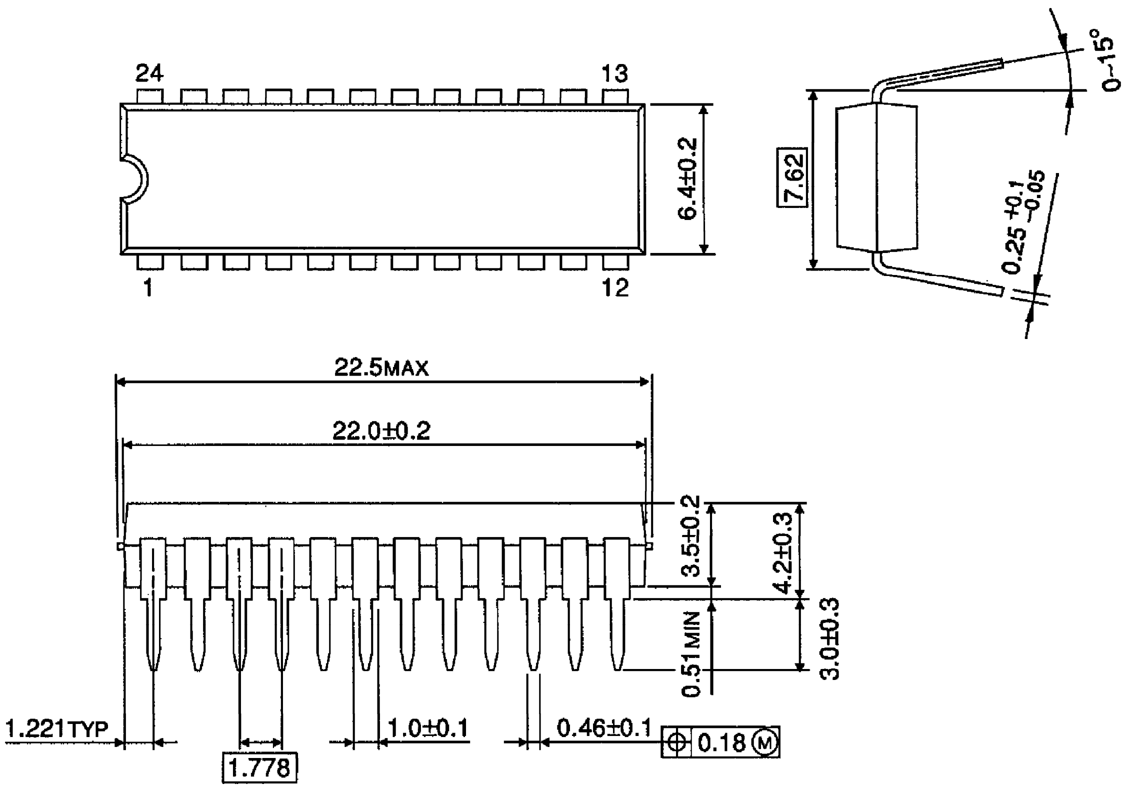

Sep, THD – fVCO
SEPARATION Sep. (dB)
FREE RUNNING FREQUENCY fVCO (kHz)
VCC = 3V
L + R = 135mVrms
P = 15mVrms
fm = 1kHz
0
20
40
60
0
0.4
0.8
1.2
72
74
76
78
80


Sep, THD – VCC
SEPARATION Sep. (dB)
TOTAL HARMONIC DISTORTION THD (%)
SUPPLY VOLTAGE VCC (V)
L + R = 135mVrms
P = 15mVrms
fm = 1kHz
Sep L→R
R→L
THD L, R
0
20
40
60
80
0
0.4
0.8
1.2
1.6
0
2
4
6
8
10


VL (ON), VL (OFF), fVCO – VCC
PILOT SIGNAL INPUT VOLTAGE VL (mVrms)
FREE RUNNING FREQUENCY fVCO (kHz)
SUPPLY VOLTAGE VCC (V)
fVCO
VL (ON)
VL (OFF)
0
4
8
12
16
20
75
76
77
0
2
4
6
8
10

OUTLINE DRAWING
SDIP24-P-300

Unit : mm



Weight : 1.2g (Typ.)