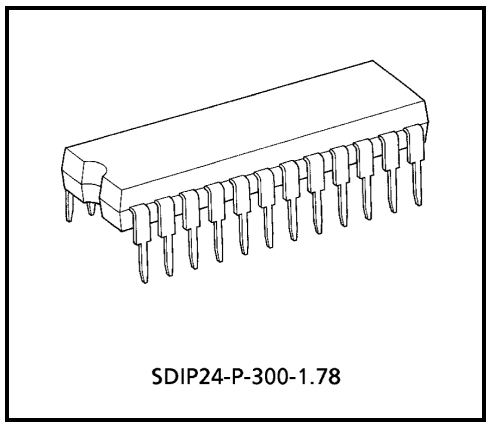
TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

TA8167N

3V AM / FM 1 CHP Tuner IC

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



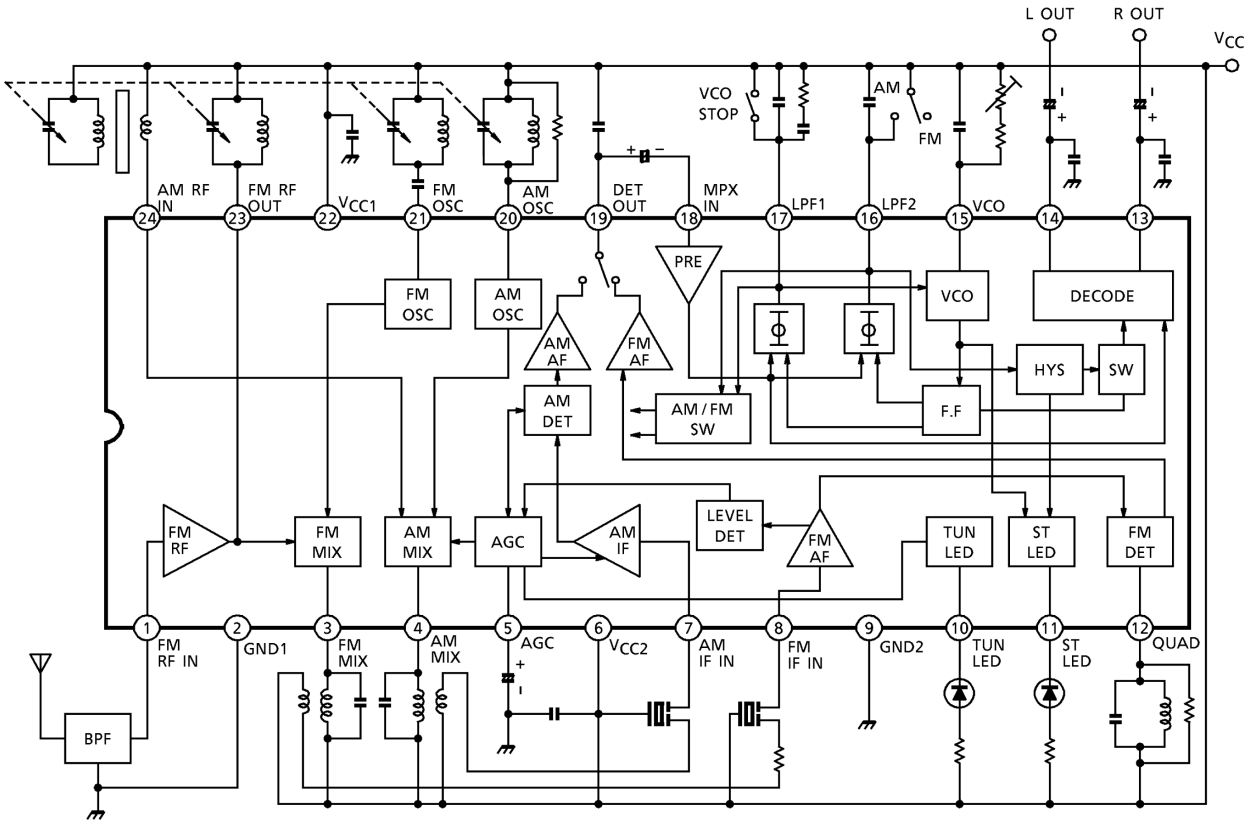
SDIP24-P-300-1.78

Weight: 1.2g (typ.)

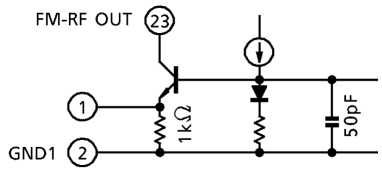
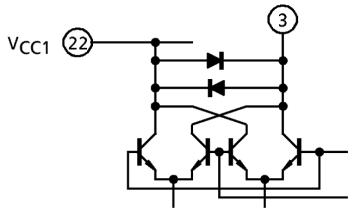
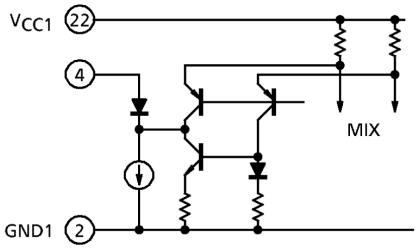
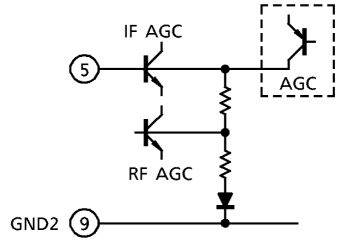
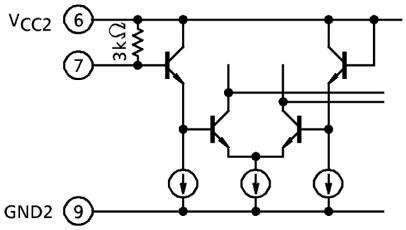
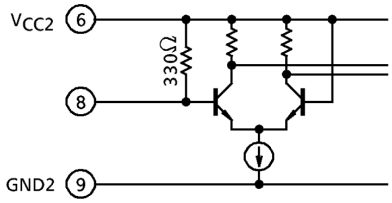
Features

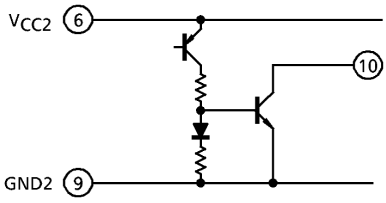
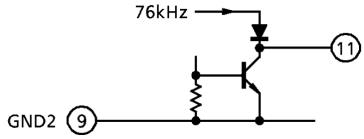
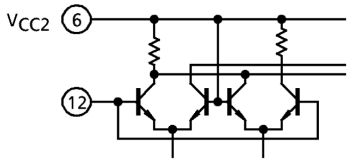
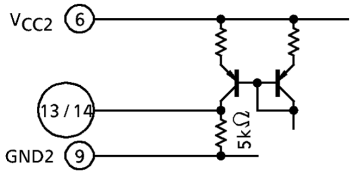
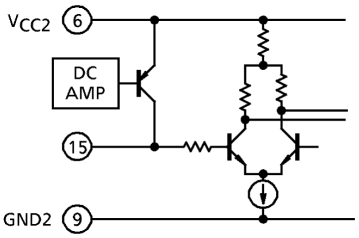
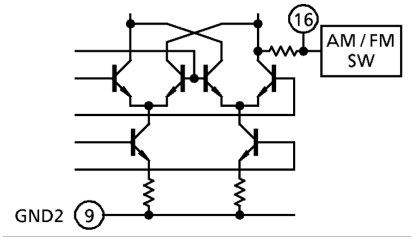
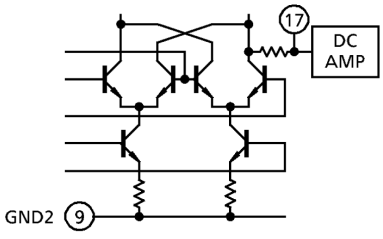
- Built−in
  FM F / E, AM / FM IF and FM MPX
- AM detector coil and IF coupling condenser are not needed.
- S curve characteristics of FM detection output is reverse characteristic.
- The FM local oscillation voltage is set up low relatively for measures against FM radiation.
- Operating supply voltage range
  V_{CC} = 1.8~7.0V (Ta = 25°C)

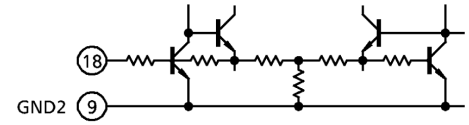
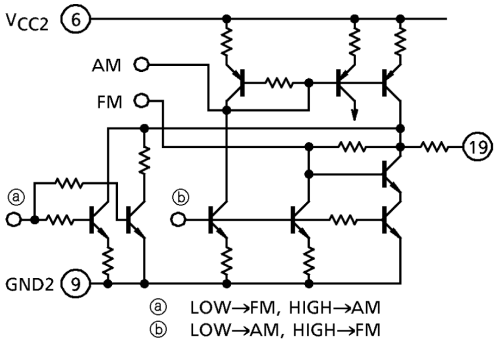
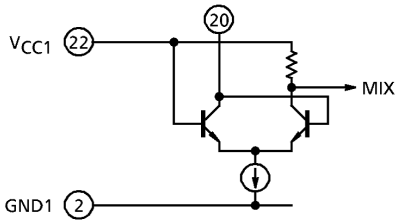
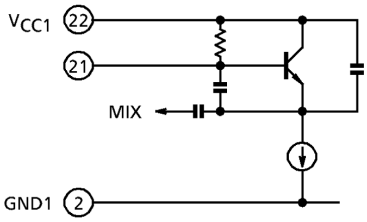
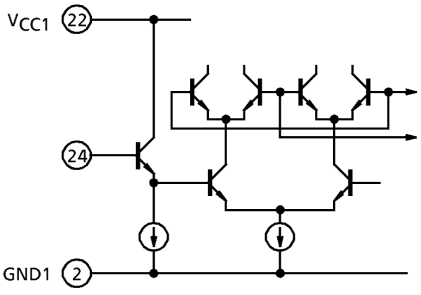
Block Diagram



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		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. pin(1)	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.

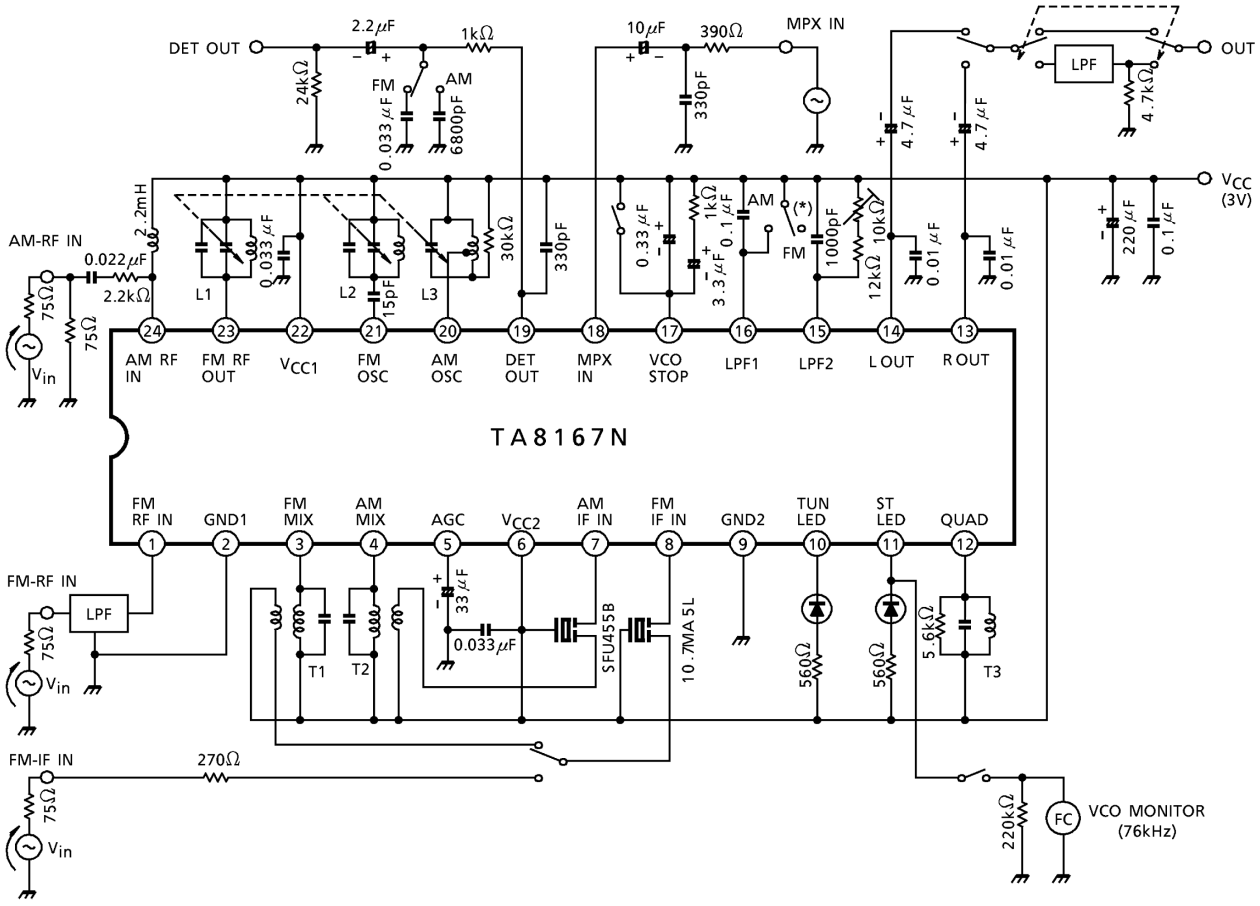
Electrical Characteristics

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 Circuit	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
Pin(19) 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

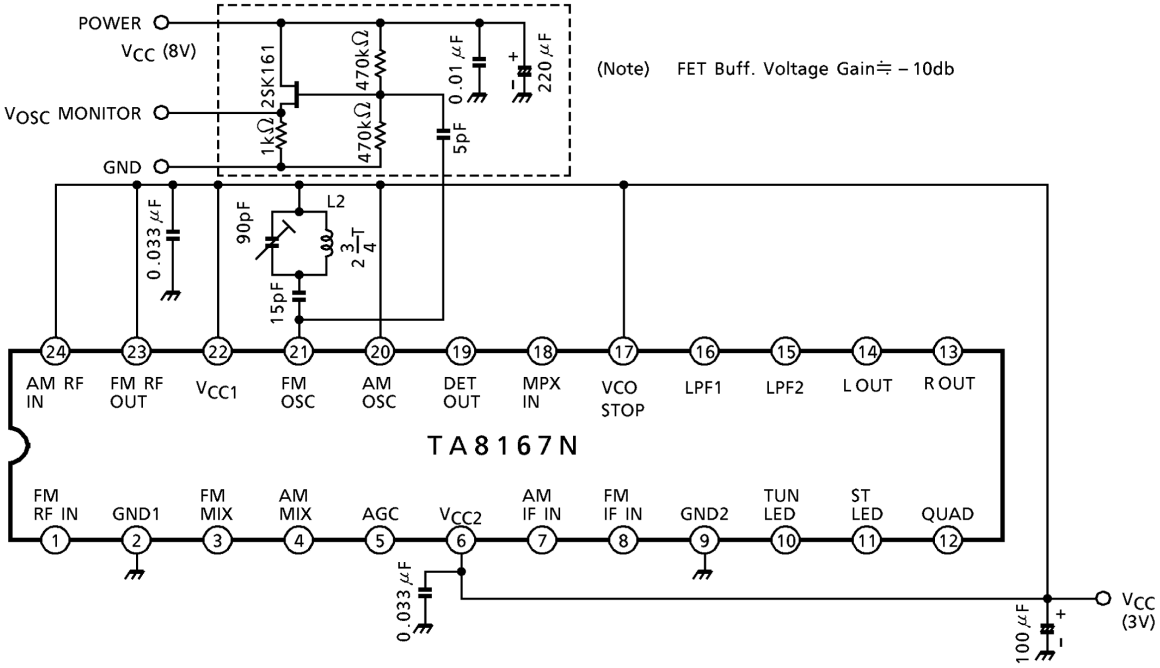
Test Circuit 1



(*) Polyester film condenser

Using other types of condensers, there are some cases that the MPX dose not do normal stereo action at high temperature or low temperature.

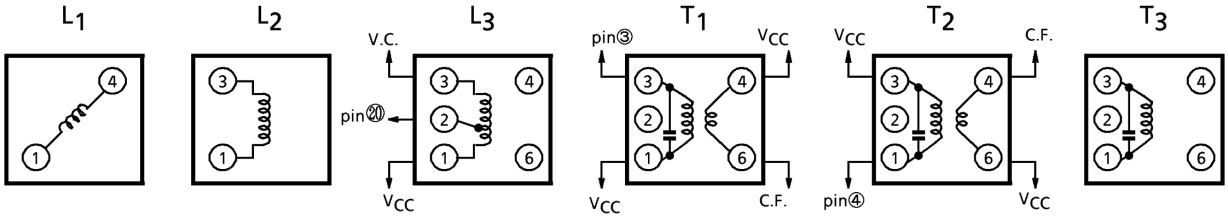
Test Circuit 2



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	—	—	—	$2\frac{1}{2}$	—	0.5 UEW	(S) 53T–037–202
L_2 FM OSC	100M	—	—	100	—	—	$2\frac{3}{4}$	—	—	0.5 UEW	(S) 0258–244
L_3 AM OSC	796k	288	—	115	13	73	—	—	—	0.08 UEW	(S) 4147–1356–038
T_1 FM mix	10.7M	—	75	100	—	—	13	—	2	0.1 UEW	(S) 2153–414–041
T_2 AM mix	455k	—	180	120	—	—	180	—	15	0.08 UEW	(S) 2150–2162–165
T_3 FM DET	10.7M	—	47	165	—	—	16	—	—	0.09 UEW	(S) 2153–4095–122

(S) : SUMIDA ELECTRIC CO., LTD.



Hint On Use Of TA8167N

○External parts of MPX VCO

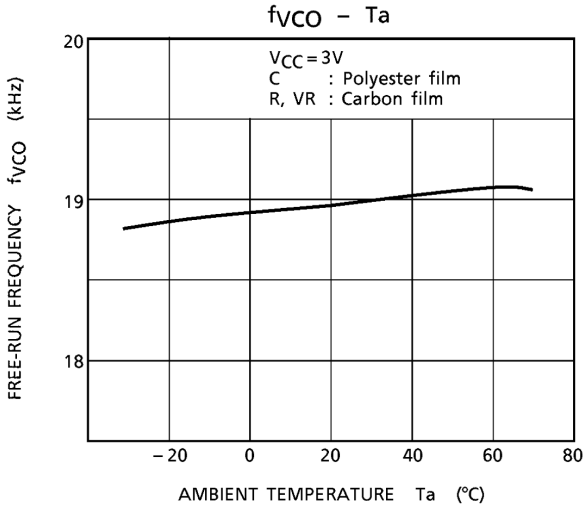
(1) Temperature characteristic of MPX VCO free–run frequency.

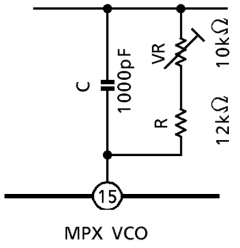
The temperature characteristic of MPX VCO is shown in the diagram as below.

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.

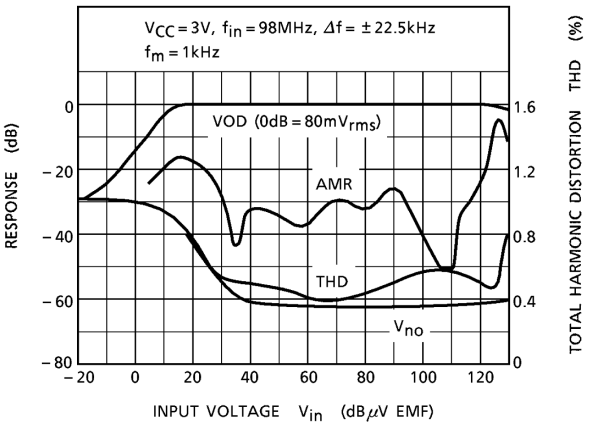
C = 1000pF

R = 12kΩ

VR = 10kΩ

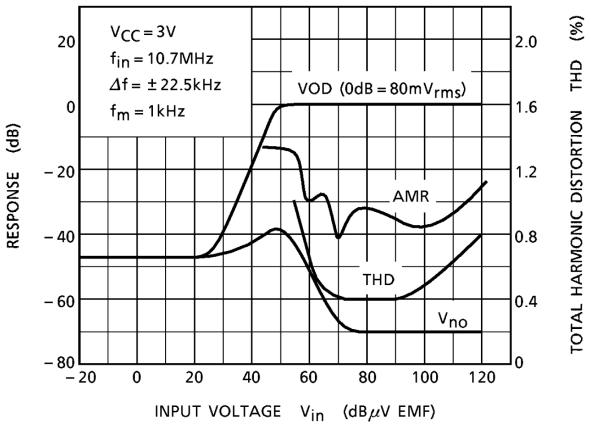
FM (F / E + IF)

V_{OD}, V_{no}, THD, AMR – V_{in}



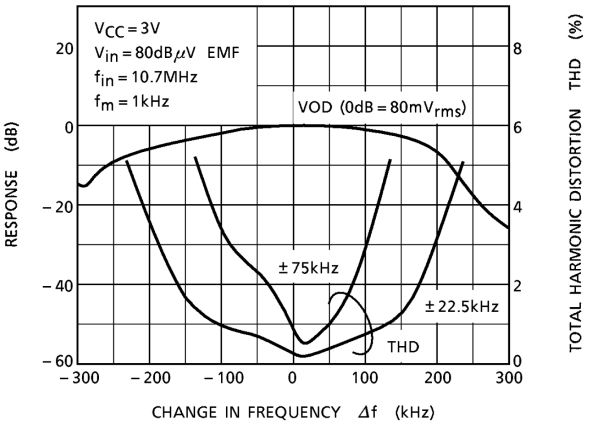
FM (IF)

V_{OD}, V_{no}, THD, AMR – V_{in}



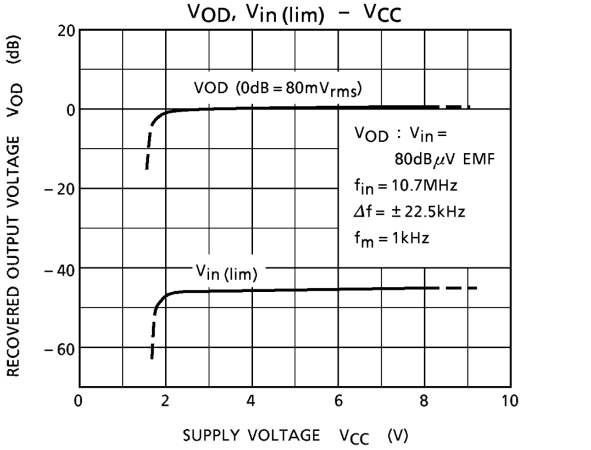
FM (IF)

V_{OD}, THD – Δf



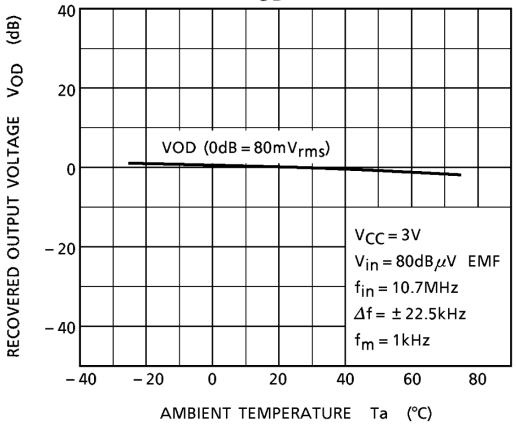
FM (IF)

V_{OD}, $V_{in\,(lim)}$ – V_{CC}



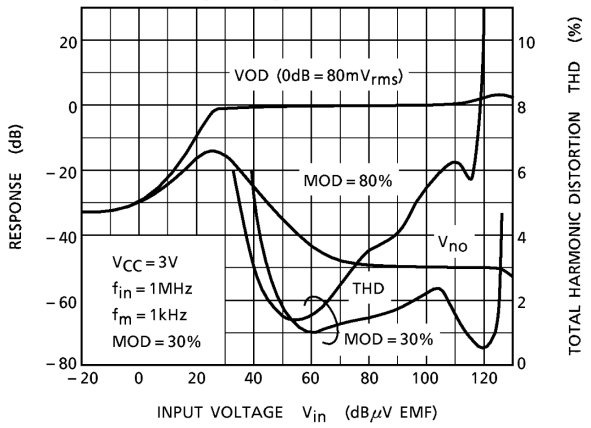
FM (IF)

V_{OD} – Ta

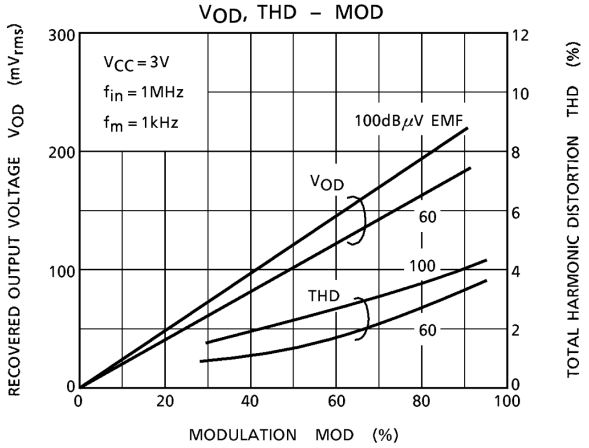


AM

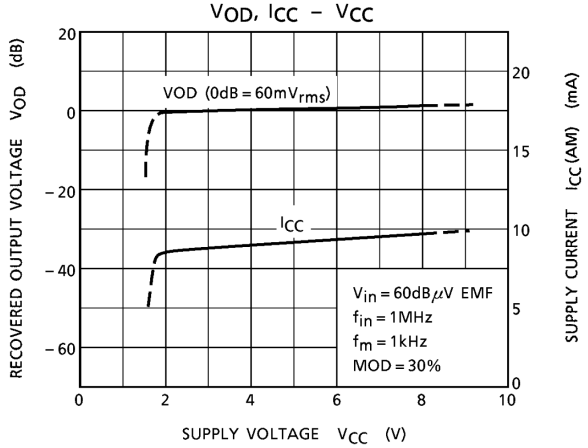
V_{OD}, V_{no}, THD – V_{in}



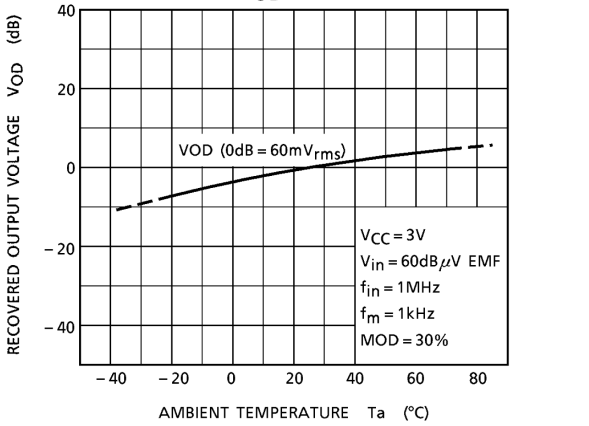
V_{OD}, THD – MOD



V_{OD}, I_{CC} – V_{CC}

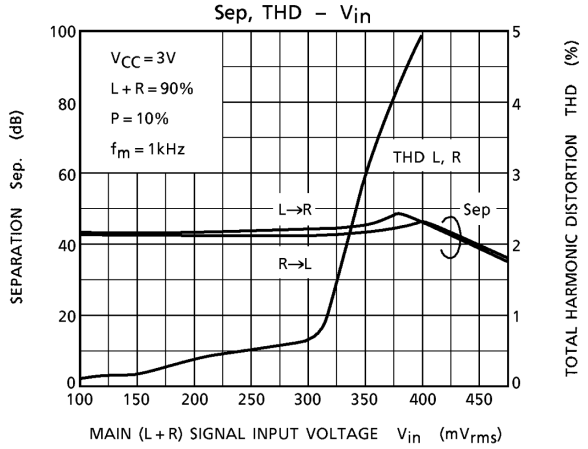


V_{OD} – Ta

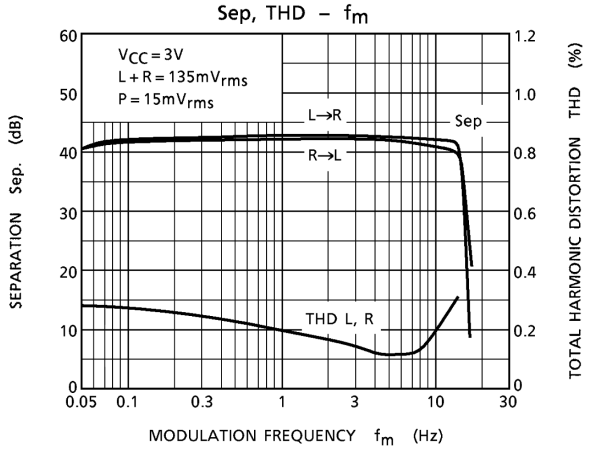


MPX

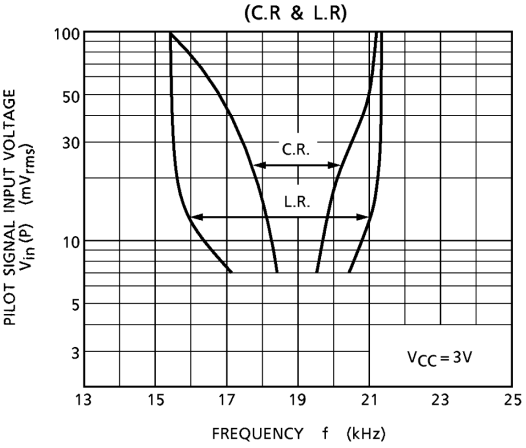
Sep, THD – V_{in}



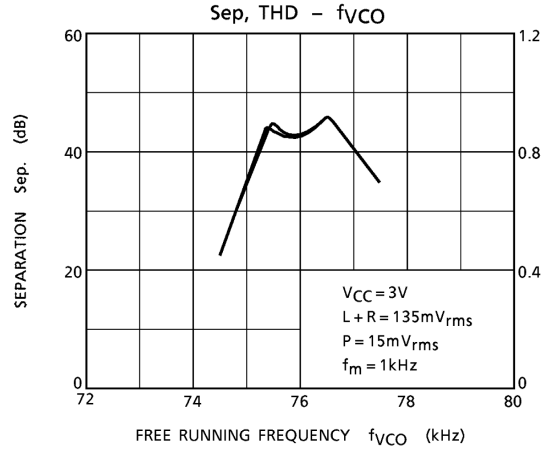
Sep, THD – f_m



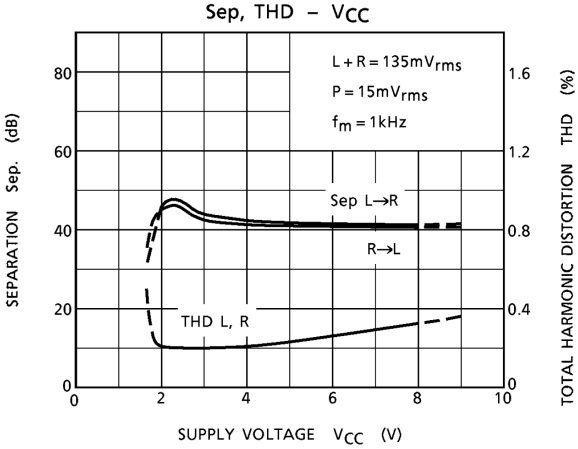
CAPTURE RANGE & LOCK RANGE (C.R & L.R)



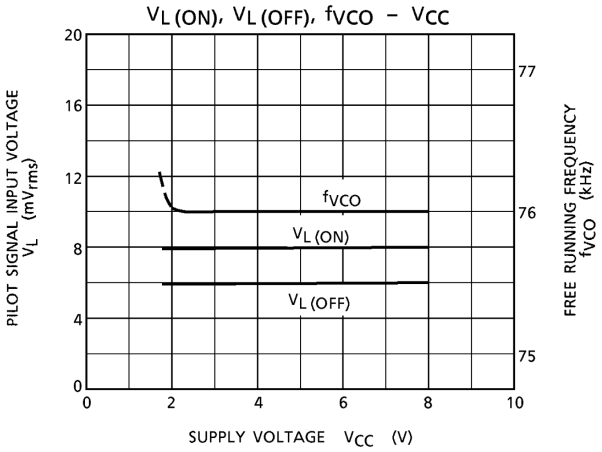
Sep, THD – f_{VCO}



Sep, THD – V_{CC}

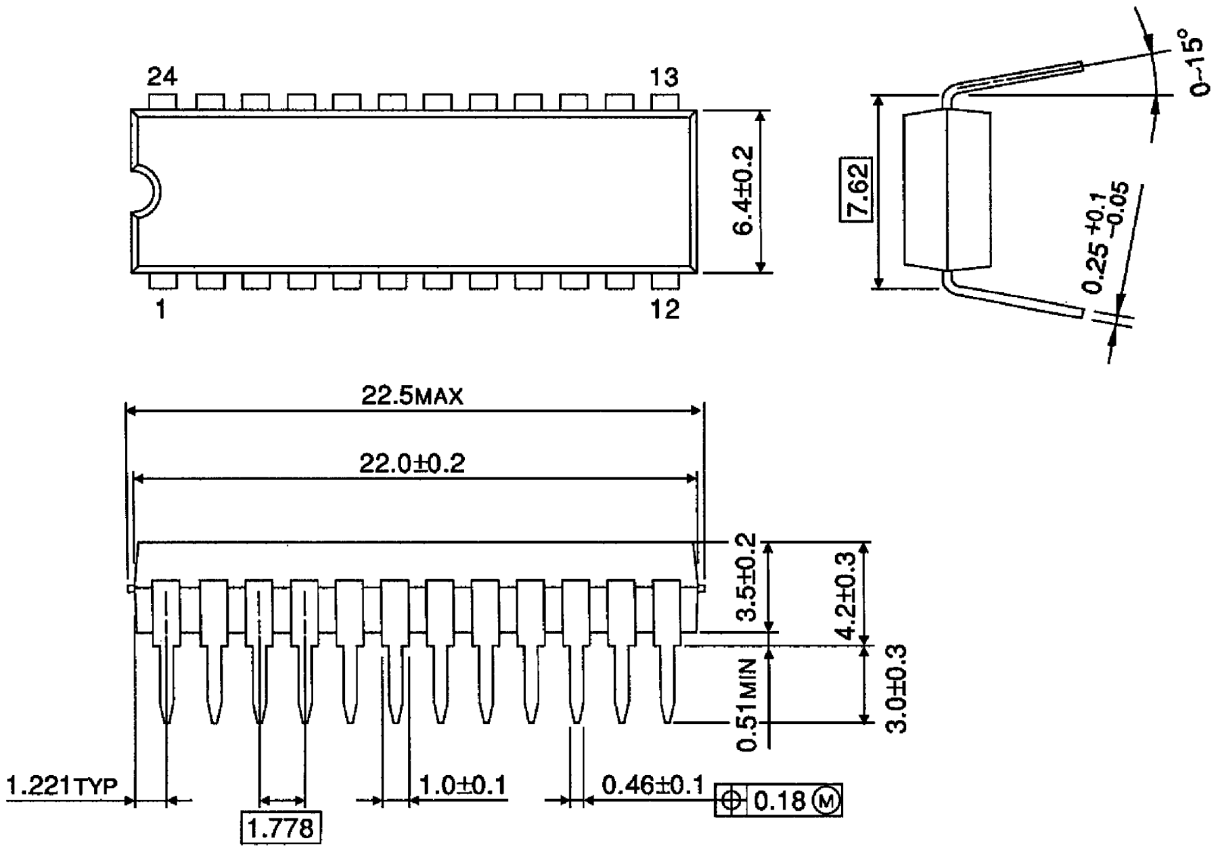


$V_{L\,(ON)}$, $V_{L\,(OFF)}$, f_{VCO} – V_{CC}



Package Dimensions

SDIP24-P-300-1.78 Unit : mm



Weight: 1.2g (typ.)

RESTRICTIONS ON PRODUCT USE

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- TOSHIBA is continually working to improve the quality and reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to comply with the standards of safety in making a safe design for the entire system, and to avoid situations in which a malfunction or failure of such TOSHIBA products could cause loss of human life, bodily injury or damage to property.
  In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent TOSHIBA products specifications. Also, please keep in mind the precautions and conditions set forth in the “Handling Guide for Semiconductor Devices,” or “TOSHIBA Semiconductor Reliability Handbook” etc..
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