

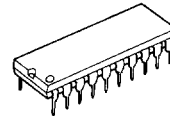
AM/FM RADIO

■ GENERAL DESCRIPTION

The NJM2237 is monolithic integrated circuit in a 20-lead dual in-line plastic package designed for use in 3-6V portable AM/FM radio receivers.

The functions incorporated are AM RF amplifier, AM mixer, FM/AM IF amplifier, FM/AM detector, AM AGC circuit Audio Power amplifier.

■ PACKAGE OUTLINE

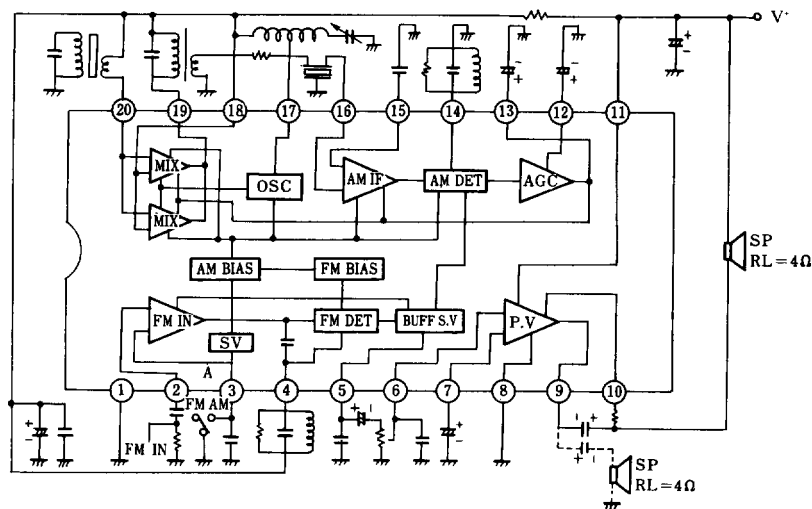


NJM 2237 D

■ FEATURES

- Wide Operating Voltage (1.8~6.0V)
- Very Simple DC switching of FM/AM
- High AM signal handling
- 4Ω speaker direct drive
- Low tweet
- Most suitable to use with NJM2236
- Package Outline DIP20
- Bipolar Technology

■ BLOCK DIAGRAM



(note) Dotted line shws $V^+ = 4.5V$



■ ABSOLUTE MAXIMUM RATINGS

(Ta=25°C)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V ⁻	8	V
Output Current	I _{O(peak)}	550	mA
Power Dissipation	P _D	1.2	W
Operating Temperature Range	T _{opr}	-20~75	°C
Storage Temperature Range	T _{stg}	-40~125	°C

■ ELECTRICAL CHARACTERISTICS

(V⁺=3V, Ta=25°C, FM: f=10.7MHz, Δf=22.5kHz dev., fm=1kHz

AM: f=1MHz, Mod=30%, fm=1kHz Unless otherwise noted)

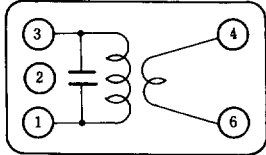
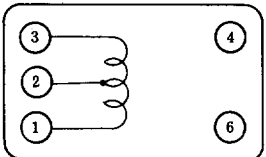
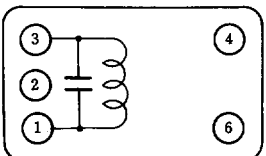
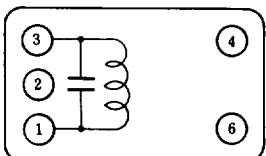
CHARACTERISTICS	SYMBOLS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Operating Current	I _{CC} (FM)	V _{IN} =0	—	15	20	mA
	I _{CC} (AM)	V _{IN} =0	—	15	20	
F M	-3dB Limiting Sensitivity	V _{IN(lim)}	—	36	42	dBμ
	Detection Output Voltage	V _{IN} =80dBμ	22	31	44	mVrms
	Signal to Noise Ratio	V _{IN} =80dBμ	—	70	—	dB
	Total Harmonic Distortion	V _{IN} =80dBμ	—	0.3	—	%
	Am Rejection Ratio	V _{IN} =80dBμ	—	33	—	dB
A M	Voltage Gain	V _{IN} =30dBμ	5	11	17	mVrms
	Detection Output Voltage	V _{IN} =66dBμ	22	31	44	mVrms
	Signal to Noise Ratio	V _{IN} =66dBμ	—	46	—	dB
	Total Harmonic Distortion	THD1 V _{IN} =66dBμ	—	1.5	—	%
		THD2 V _{IN} =106dBμ	—	4.0	—	
	Local OSC Stop Voltage	V _{STOP} V _{OSC} -6dB	—	1.0	1.5	V
P W	Voltage Gain	G _V f=1kHz, R _L =4Ω	37	40	43	dB
	Output Power	P _{OD1} f=1kHz, R _L =4Ω, THD=10%	180	220	—	mW
		P _{OD2} V ⁺ =4.5V f=1kHz, R _L =4Ω, THD=10%	—	500	—	
	Total Harmonic Distortion	THD f=1kHz, R _L =4Ω, P _O =50mW	—	0.5	20	%
	Output Noise Voltage	V _{NO} R _O =10kΩ, R _L =4Ω BW=30Hz~20kHz	—	0.18	—	mVrms

($V^+ = 3V$, $T_a = 25^\circ C$)

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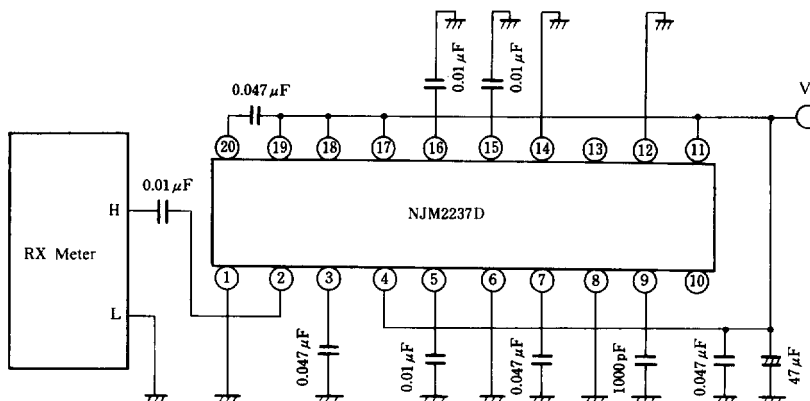
■ TEST CIRCUIT COIL DATA

COIL NO.	F ₀	Q ₀	TURNS	C ₀	BOTTOM VIEW
T ₁ : FM IFT (MIX OUT)	455kHz	①-③ 80	①-③ 60T ④-⑥ 16T Wire : 0.09mmφ UEW SUMIDA 2150-2173-302	①-③ 1500pF	 Bottom View
T ₂ : AM OSC	796kHz	①-③ 125	①-② 15T ②-③ 89T Wire : 0.06mmφ UEW SUMIDA 2157-2239-213A	—	 Bottom View
T ₃ : AM DET	455kHz	①-③ 105	①-③ 127T Wire : 0.06mmφ UEW SUMIDA 2150-2083-061	①-③ 330pF	 Bottom View
T ₄ : FM DET	10.7MHz	①-③ 100	①-③ 10T Wire : 0.12mmφ UEW SUMIDA 2153-4095-331	①-③ 150pF	 Bottom View

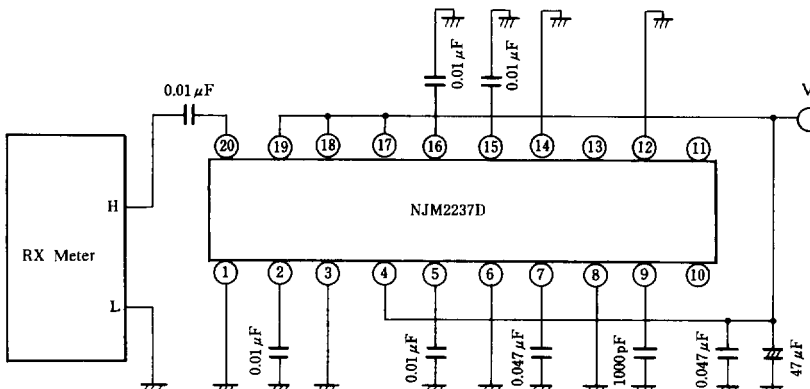
■ INPUT OUTPUT IMPEDANCE

CHARACTERISTIC	SYMBOL	CIRCUIT	TEST CONDITION	TYP.	UNIT
Pin 2 Input Impedance (FM)	R_{IN2} C_{IN2}	1	$f=10.7\text{MHz}$	4.6 5.0	$k\Omega$ pF
Pin 20 Input Impedance (AM)	R_{IN20} C_{IN20}	2	$f=1\text{MHz}$	20 11	$k\Omega$ pF
Pin 16 Input Impedance (AM)	R_{IN16} C_{IN16}	3	$f=455\text{kHz}$	6 3.7	$k\Omega$ pF
Pin 19 Output Impedance (AM)	R_{O19} C_{O19}	4	$f=455\text{kHz}$	2.5 5.5	$k\Omega$ pF
Pin 14 Output Impedance (AM)	R_{O14} C_{O14}	5	$f=455\text{kHz}$	100 5.0	$k\Omega$ pF

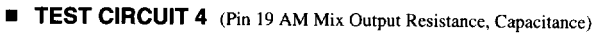
■ TEST CIRCUIT 1 (Pin 2 FM Input Resistance, Capacitance)



■ TEST CIRCUIT 2 (Pin 20 AM Input Resistance, Capacitance)



■ **TEST CIRCUIT 3** (Pin 16 AM IF Input Resistance, Capacitance)





■ NOTES

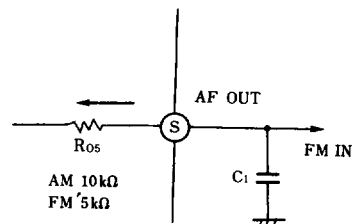
1. The frequency characteristics at AM and FM mode

The output impedance of pin5 (R_{O5}) and external capacitor C_1 decide frequency characteristics.

The value of R_{O5} turns to $10k\Omega$ at AM mode and $5k\Omega$ at FM mode.

Accordingly should consider above, trim C_1 to get proper frequency response.

Besides should design the location of C_1 closer to pin1 (GND) to get low tweet.



2. Loading speaker

Recommend to connect the speaker between pin11 (V^+) and pin10 (bootstrap) at $V^+ = 3V$ for better low supply to voltage operation.

When V_{CC} is above $4.5V$, recommend the speaker connection between pin9 (PW OUT) and (GND) through a coupling capacitor.

3. Termination to the power stage

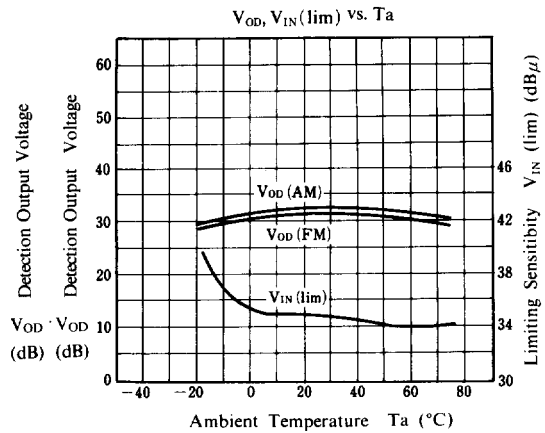
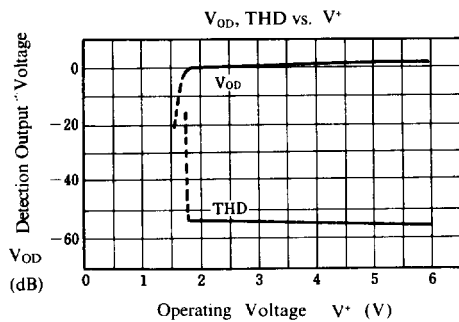
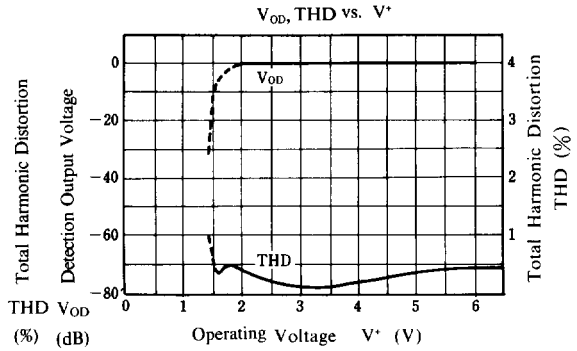
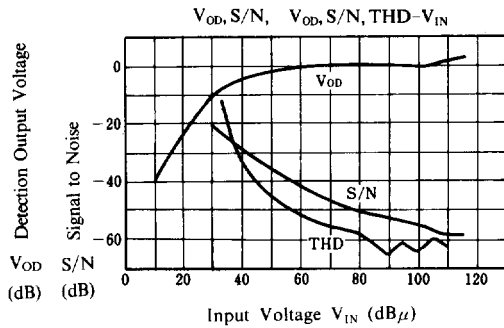
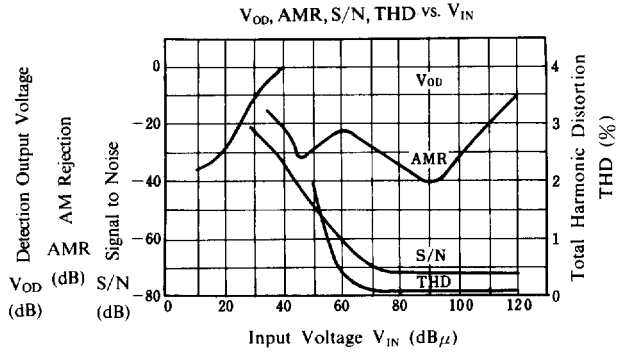
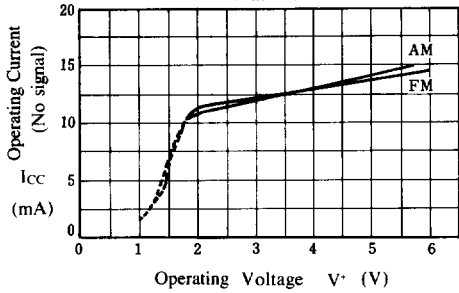
The audio signal of output pin5 includes carrier component slightly, therefore a capacitor between pin6 and GND have to be connected to decrease carrier component.

4. Supply voltage start-up

The supply voltage of radio circuit block should not start up before power stage start-up.

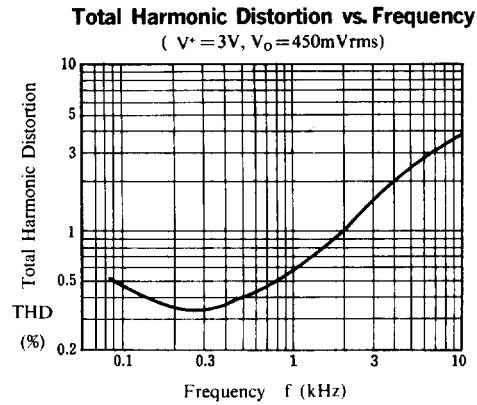
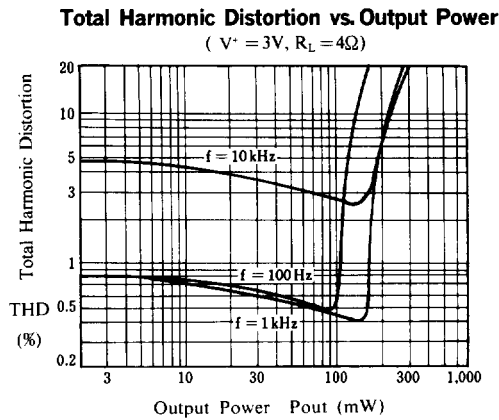
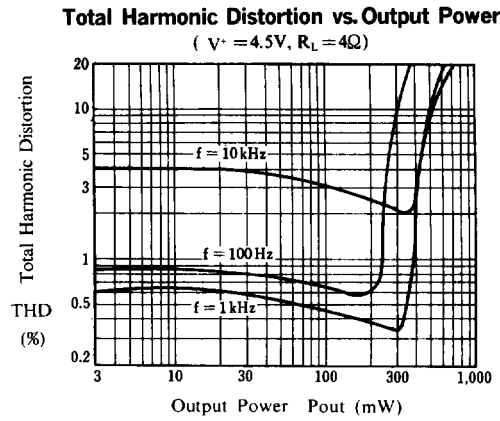
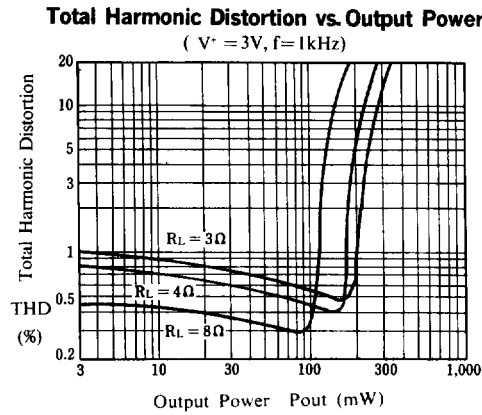
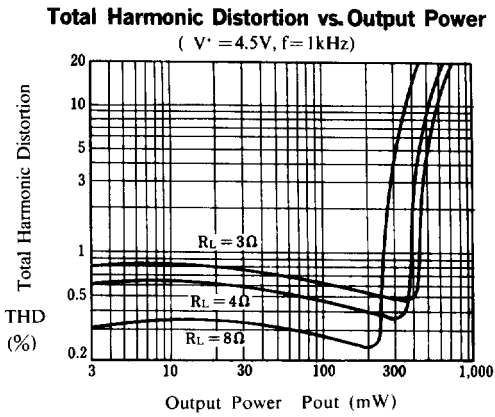
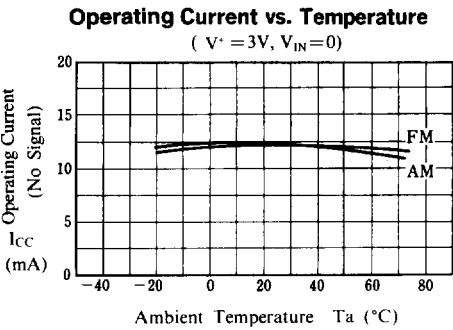
TYPICAL CHARACTERISTICS

Operating Current vs. Operating Voltage
($V_{IN}=0$)





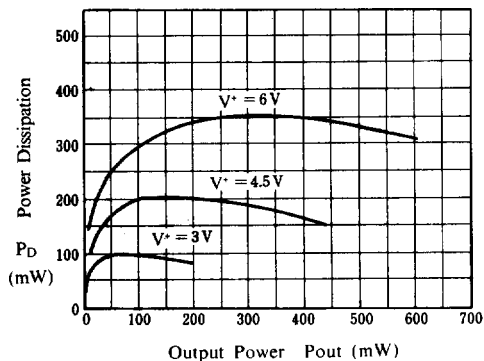
■ TYPICAL CHARACTERISTICS



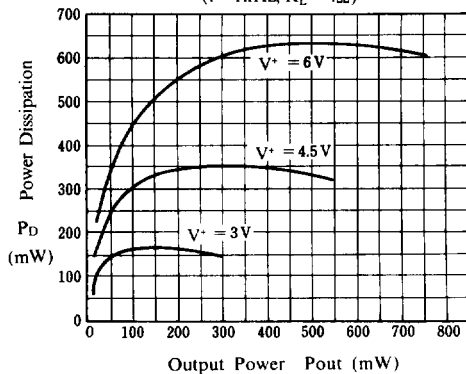


TYPICAL CHARACTERISTICS

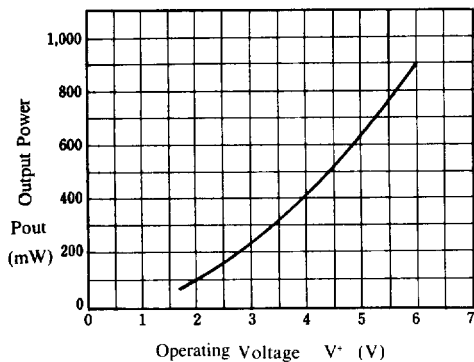
Power Dissipation vs. Output Power
($f=1\text{kHz}$, $R_L=8\Omega$)



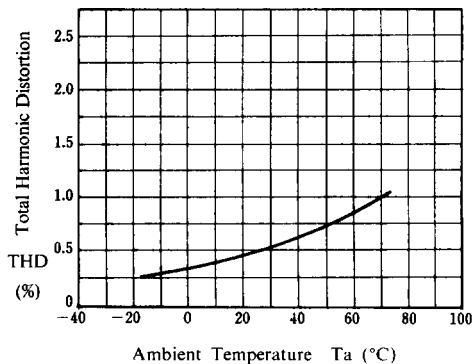
Power Dissipation vs. Output Power
($f=1\text{kHz}$, $R_L=4\Omega$)



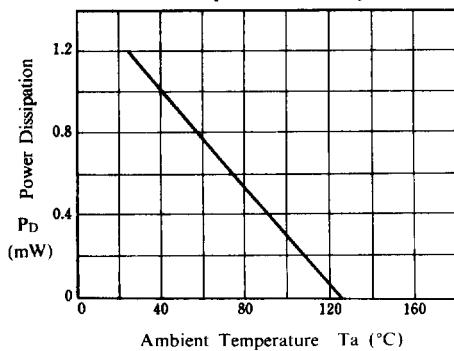
Output Power vs. Operating Voltage
($f=1\text{kHz}$, $\text{THD}=10\%$, $R_L=4\Omega$)



Total Harmonic Distortion vs. Temperature
($V^*=3\text{V}$, $f=1\text{kHz}$, $R_L=4\Omega$)

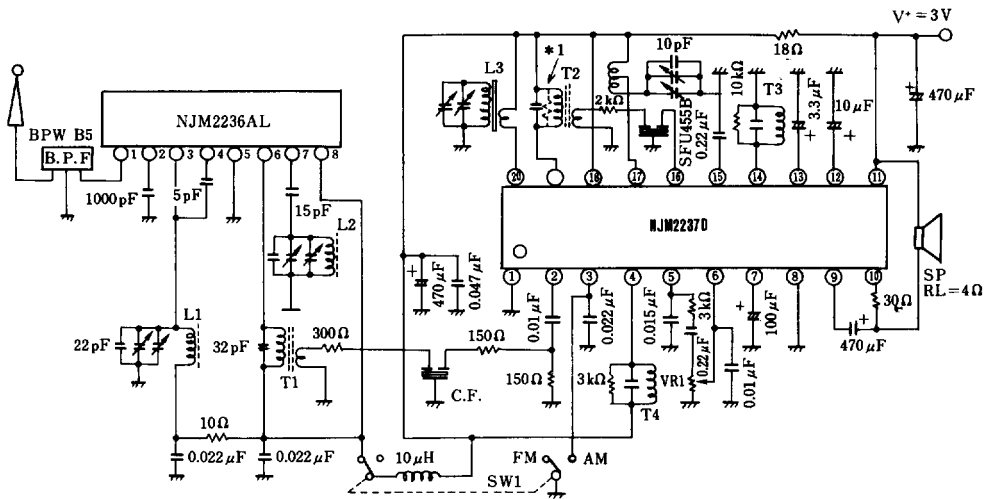


Power Dissipation vs. Temperature





■ FM/AM RADIO APPLICATION CIRCUIT





■ FM/AM RADIO APPLICATION CIRCUIT

COIL NO.	F ₀	Q ₀	URNS	C ₀	BOTTOM VIEW
L ₁ : RF Coil	100 MHz	100	0.7mmφ 2 $\frac{1}{4}$ T (Japan Band) SUMIDA 0295-057	22 pF (ext.)	Ferrite Core
L ₂ : OSC Coil	100 MHz	100	0.7mmφ 2 $\frac{1}{2}$ T (Japan Band) SUMIDA 0295-056	30 pF (ext.)	Ferrite Core
L ₃ : AM ANT	796 kHz	①-② 200	①-② 100 T L=600 μH ③-④ 17 T Wire : 4/0.07mm UATC Core : 10mmφ×80mm MITUMI YI-7160-1	—	BOTTOM VIEW
L ₄ : AM OSC	796 kHz	①-③ 125	①-② 15 T ②-③ 89 T Wire : 0.06mmφ UEW SUMIDA 2157-2239-213A	—	BOTTOM VIEW



COIL NO.	F ₀	Q ₀	TURNS	C ₀	BOTTOM VIEW
T ₁ : FM IFT	10.7MHz	①-③ 90	①-③ 11 T ④-⑥ 2 T Wire : 0.12mmφ UEW SUMIDA 2153-414-041	①-③ 82pF	
T ₂ : AM IFT	455 kHz	①-③ 80	①-③ 60 T ④-⑥ 16 T Wire : 0.09mmφ UEW SUMIDA 2150-2173-302	①-③ 1500pF	
T ₃ : AM DET	455 kHz	①-③ 105	①-③ 127 T Wire : 0.06mmφ UEW SUMIDA 2150-2083-061	①-③ 3330pF	
T ₄ : FM DET	10.7MHz	①-③ 100	①-③ 10 T Wire : 0.12mmφ UEW SUMIDA 2153-4095-331	①-③ 150pF	