

1.5V AM/FM+MPX
(for Digital Tuning System)

The KIA2022AFN is AM/FM IF+MPX system IC, which is designed for DTS Radios. This is included many functions and these can be used for digital tuning system with IF counter.

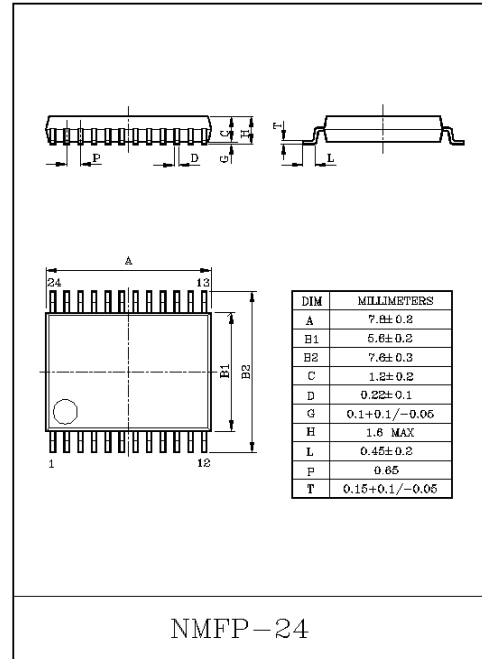
FEATURES

- IF counter of digital tuning system.
Built in IF counter.
FM : 10.7MHz
AM : 450kHz
Adjustable for stop pulse sensitivity on FM search.
- For adopting ceramic discriminator and ceramic resonator, it is not necessary to adjust the FM quad detector.
- Independent for FM stereo main signal input terminal and FM stereo pilot signal input terminal on MPX input terminal. (AM signal input terminal is too.)
- Built-in AM IF output.
- Built-in power ON/OFF function.
- MPX output is high impedance in power off mode.
- Built-in AM/FM switch.
- Operating supply voltage range. (Ta=25°C)
: $V_{CC(opr)}=0.95\sim 2.2V$.
- STEREO operating supply voltage range. (Ta=25°C)
: $V_{CC(opr)}=1.0\sim 2.2V$.

MAXIMUM RATINGS (Ta=25°C)

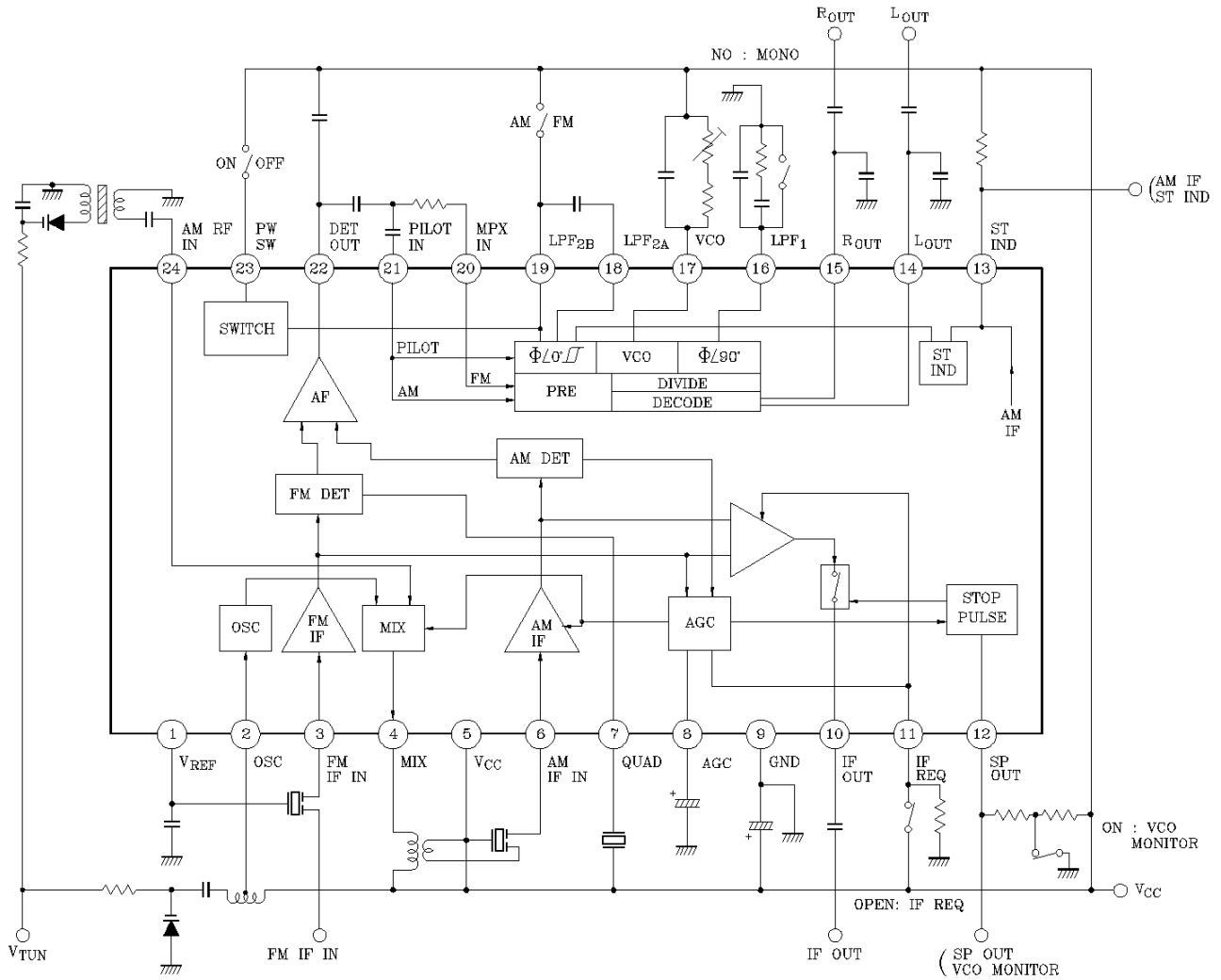
CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage	V_{CC}	4.5	V
Stop Pulse Voltage	V_{SP}	4.5	V
Stop Pulse Current	I_{SP}	10	mA
Stereo Indicator Voltage	V_{ST}	4.5	V
Stereo Indicator Current	I_{ST}	10	mA
Power Dissipation	P_D (Note)	500	mW
Operating Temperature	T_{opr}	-25~75	°C
Storage Temperature	T_{stg}	-55~150	°C

Note) Derated above Ta=25°C in the proportion of 4mW/°C.



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BLOCK DIAGRAM



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ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, $V_{CC}=1.2V$, $T_a=25^{\circ}C$, SW1 : a, SW4 : OPEN, SW5 : a, SW6 : a/b, SW7 : ON

FM IF : $f=10.7MHz$, $f_m=1kHz$, $\Delta f=\pm 22.5kHz$, $V_{IN}=80dB\mu V$ EMF, SW2 : ON, SW3 : b

AM : $f=1MHz$, $f_m=1kHz$, MOD : 30%, $V_{IN}=60dB\mu V$ EMF, SW2 : OPEN, SW3 : a

MPX : $f_m=1kHz$, $f_p=19kHz$, SW3 : b)

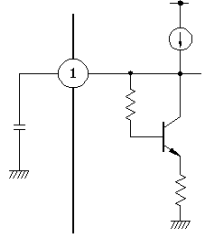
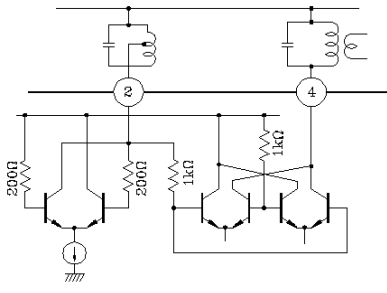
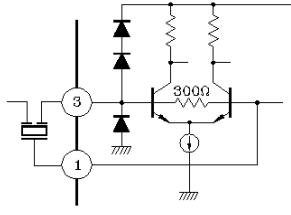
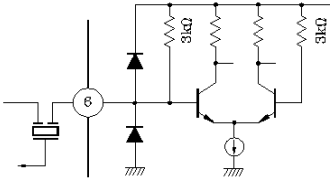
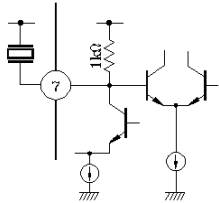
CHARACTERISTIC		SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Supply Current		I_{CC1}	1	Power off, SW1 : b	-	-	-	μA	
		I_{CC2}		FM Mode, $V_{IN}=0$	-	5.5	-	mA	
		I_{CC3}		AM Mode, $V_{IN}=0$	-	3.7	-		
FM IF	Input Limiting Voltage	$V_{IN(lim)}$	1	-3dB Limiting Point	43	48	53	$dB\mu V$ EMF	
	Recovered Output Voltage	V_{OD}		35	55	70	mV_{rms}		
	Signal to Noise Ratio	S/N		-	60	-	dB		
	Total Harmonic Distortion	THD		-	0.5	-	%		
	AM Rejection Ratio	AMR		MOD=30%		-	40	-	dB
	Stop Pulse Sense 1	SP1		$I_{I2}=0.5mA$, SW6 : a		50	55	60	$dB\mu V$ EMF
	Stop Pulse Sense 2	SP2		$I_{I2}=0.5mA$, $R_{SEN}=39k\Omega$, SW6 : a, SW7 : OPEN		-	64	-	
	IF Count Output Voltage	$V_{IF(FM)}$		SW7 : OPEN		-	80	-	mV_{P-P}
AM	Gain	G_V	1	$V_{IN}=26dB\mu V$ EMF	15	27	-	mV_{rms}	
	Recovered Output Voltage	V_{OD}		30	45	60			
	Signal to Noise Ratio	S/N		-	38	-	dB		
	Total Harmonic Distortion	THD		-	1.5	-	%		
	Stop Pulse Sense	SP3		$I_{I2}=0.5mA$, SW6 : a		25	30	35	$dB\mu V$ EMF
	IF Count Output Voltage	$V_{IF(AM)}$		SW7 : OPEN		-	100	-	mV_{P-P}
	Local OSC Voltage	V_{OSC}		2		30	55	-	mV_{rms}
	Local OSC Stop Voltage	V_{stop}				-	-	0.95	V

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CHARACTERISTIC		SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT		
MPX	Voltage Gain 1	$G_{V(FM)}$	1	$V_{IN}=100mV_{rms}$ (monaural)	-1.5	+0.5	+2.5	dB		
	Voltage Gain 2	$G_{V(AM)}$			-0.5	+1.5	3.5			
	Channel Balance	CB			-2	-	+2			
	Max. Composite Signal Input Voltage			$V_{IN(MAX)}$	L+R=90%, P=10%, THD=3%	-	220	-	mV_{rms}	
	Total Harmonic Distortion	Mono		THD3	$V_{IN}=100mV_{rms}$ (monaural)	-	0.2	0.5	%	
		Stereo		THD4	L+R=90 mV_{rms} , P=10 mV_{rms}	-	0.3	-		
		AM		THD5	$V_{IN}=100mV_{rms}$	-	0.2	-		
	Separation			SEP	L+R=90 mV_{rms} P=10 mV_{rms}	fm=100Hz	-	36	-	dB
						fm=1kHz	25	35	-	
						fm=10kHz	-	34	-	
	Stereo Indicator Sensitivity	ON		$ST_{(ON)}$	Pilot Signal Input $I_{I3}=0.5mA$, SW5 : a	-	5.5	8	mV_{rms}	
		OFF		$ST_{(OFF)}$		2	4	-		
	Stereo Indicator Hysteresis			V_H	Stereo Indicator ON/OFF Hysteresis	-	1.5	-	mV_{rms}	
Capture Range		CR	P=10 mV_{rms} , fp=19kHz	-	± 7	-	%			
Signal to Noise Ratio		S/N	$V_{IN}=100mV_{rms}$ (monaural)	-	65	-	dB			
Power ON Correction Current		I_{23}	2	$V_{CC}=0.95V$	SW1 : c	5	-	-	μA	
Power OFF Correction Voltage		V_{23}			SW1 : d	0	-	0.3	V	
AM Mode Correction Current		I_{19}			SW3 : c	50	-	-	μA	
FM Forced Mono. Correction Voltage		V_{16}			SW4 : ON	-	0.1	-	V	
IF Request Cancel Correction Voltage		V_{11}			SW7 : ON	0.9	-	-	V	

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EXPLANATION OF TERMINALS

PIN NO.	TERMINAL NAME	CONTENTS	INTERNAL EQUIVALENT CIRCUIT	DC VOLTAGE (V) (at No Signal)	
				AM	FM
1	V _{REF}	Reference Voltage Circuit AM RF) By Pass FM IF		0.9	0.9
2	OSC	AM OSC		1.2	1.2
4	MIX	AM MIX. OUT		1.2	1.2
3	FM IF IN	FM IF INPUT · Input Impedance : 330Ω (Typ.)		0.9	0.9
5	V _{CC}	-	-	1.2	1.2
6	AM IF IN	AM IF Input · Input Impedance : 3kΩ (Typ.)		1.2	1.2
7	QUAD	FM Quadrature Detector.		1.2	1.2

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EXPLANATION OF TERMINALS

PIN NO.	TERMINAL NAME	CONTENTS	INTERNAL EQUIVALENT CIRCUIT	DC VOLTAGE (V) (at No Signal)	
				AM	FM
8	AGC	<p>AGC Terminal (AM)</p> <p>AM : Constant of AGC to Decide</p> <p>FM : Level Change of Stop Pulse Signal to Controlled</p>		-	-
9	GND	-	-	0	0
10	IF OUT	<p>IF Count Output</p> <p>FM : $V_{IF(FM)}=80mV_{P-P}$ (Typ.)</p> <p>AM : $V_{IF(AM)}=100mV_{P-P}$ (Typ.)</p>		-	-
11	IF REQ	<p>IF Request Switch</p> <p>[VCC : Receiving Mode Open : IF Request</p>		-	-
12	SP OUT	<p>Stop Pulse Output</p> <p>[ON : VCO monitor OPEN : SP out</p>		-	-
13	ST IND	<p>Stereo Indicator Terminal.</p> <ul style="list-style-type: none"> With a AM IF Modulation Output. AM IF Output : $6mV_{rms}$ ($R_{IF}=3k\Omega$, Typ.) 		-	-

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EXPLANATION OF TERMINALS

PIN NO.	TERMINAL NAME	CONTENTS	INTERNAL EQUIVALENT CIRCUIT	DC VOLTAGE (V) (at No Signal)	
				AM	FM
14	L _{OUT}	Stereo Output Terminal.		0.5	0.5
15	R _{OUT}	Power OFF : High Impedance			
16	L _{PF1}	LPF Terminal for Phase Detector. V ₁₆ =GND→FM Mono.		-	-
17	V _{CO}	VCO Control Terminal.		-	1.2
18	L _{PF2A}	LPF Terminal for Pilot Detector.		-	-
19	L _{PF2B}	LPF Terminal for Pilot Detector. FM/AM Mode Switch V _{CC} : AM Mode Open : FM Mode		1.2	-
21	PILOT IN	FM Stereo Pilot Signal and AM Signal Input Terminal.		0.1	0.1

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EXPLANATION OF TERMINALS

PIN NO.	TERMINAL NAME	CONTENTS	INTERNAL EQUIVALENT CIRCUIT	DC VOLTAGE (V) (at No Signal)	
				AM	FM
20	MPX IN	FM Stereo Main Signal Input Terminal.		-	0.1
22	DET OUT	Detector Output Circuit Output Impedance (Typ.) AM : 10kΩ FM : 1k		0.6	0.6
23	PW SW	Power ON/OFF Switch [V _{CC} : IC ON OPEN/GND : IC OFF.		1.2	1.2
24	AM RF IN	AM RF Input · Input Impedance : 13kΩ (No Signal, Typ.)		0.9	0

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TEST CIRCUIT 1

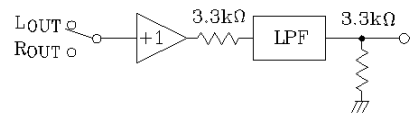
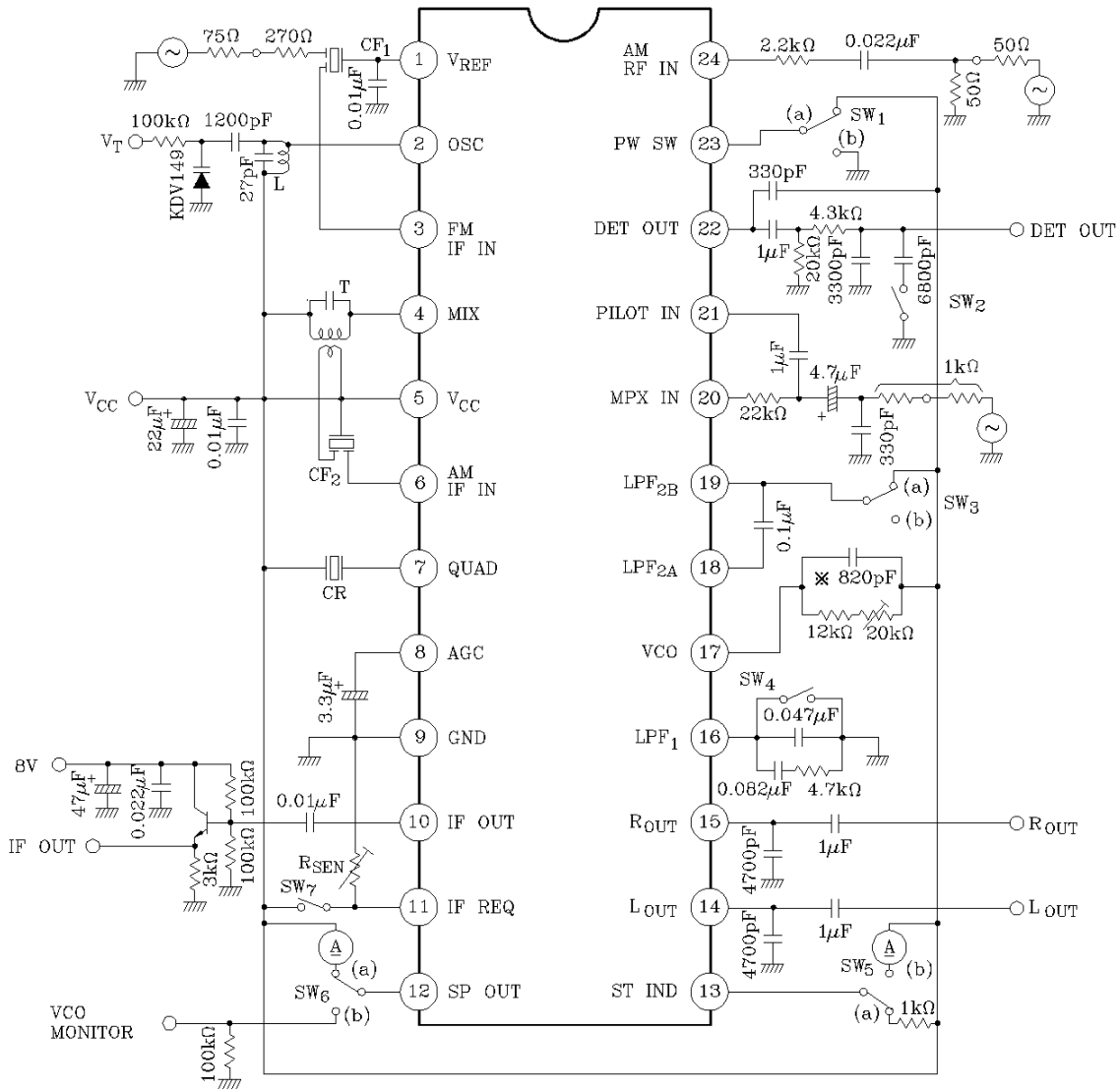


Fig.9 FILTER CIRCUIT

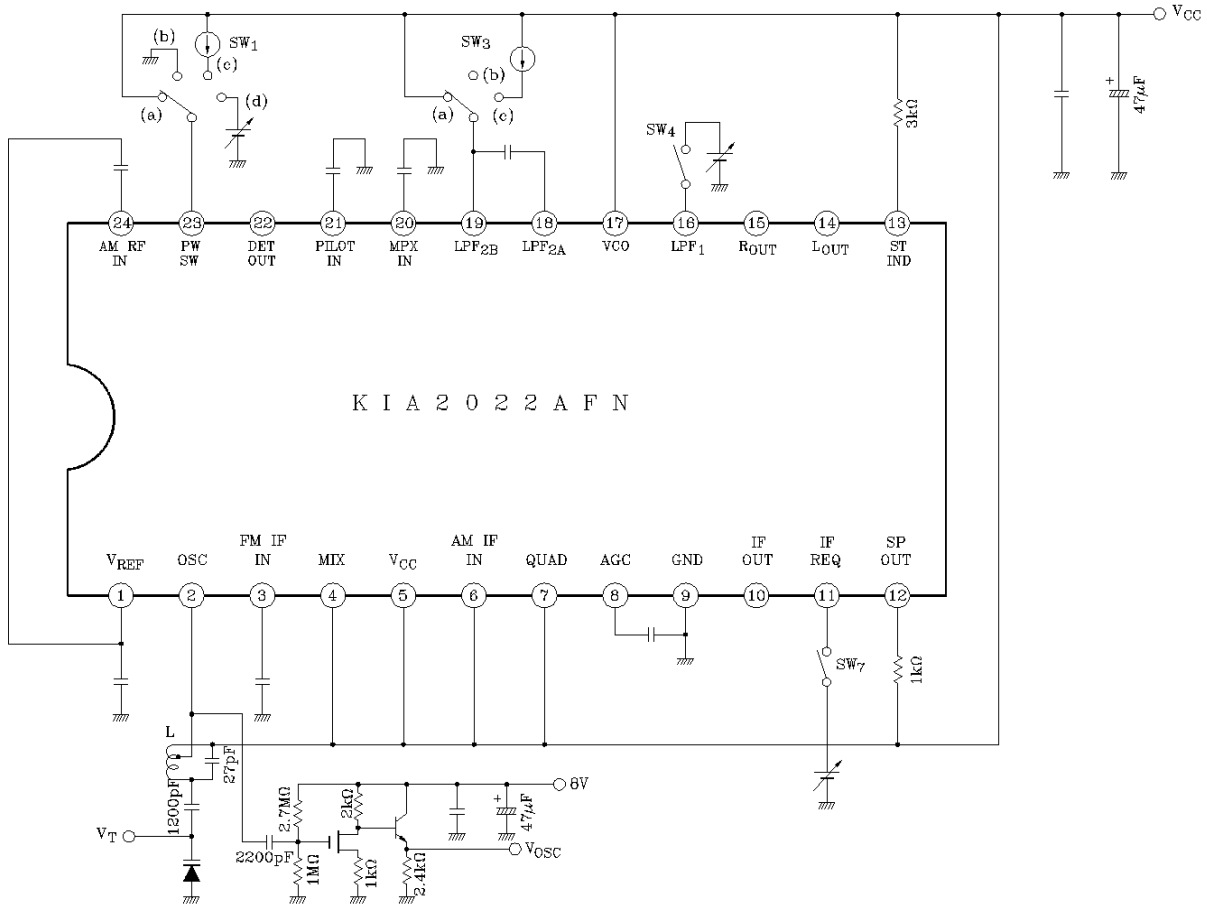
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TEST COIL DATA

COIL SYMBOL	TEST FREQUENCY	L (μ H)	C ₀ (pF)	Q ₀	TURNS				WIRE (mm ϕ)	REFERENCE
					1-2	2-3	1-3	4-6		
L AM OSC	796kHz	100	-	85	13	55	-	-	0.06 UEW	Ⓢ 4187-144
T AM IFT	450kHz	-	180	65	-	-	184	29	0.05 UEW	Ⓢ 4161-242

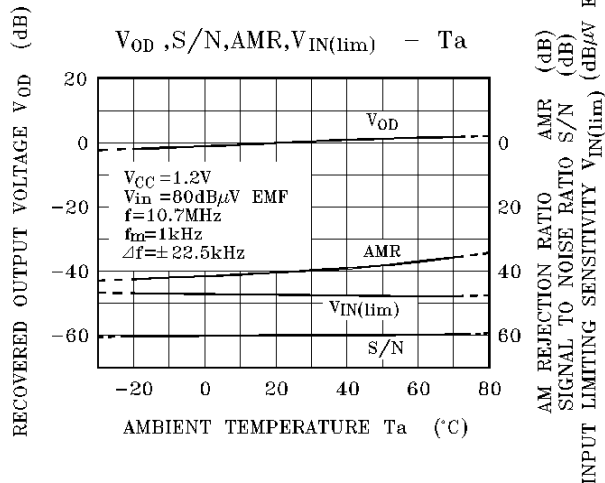
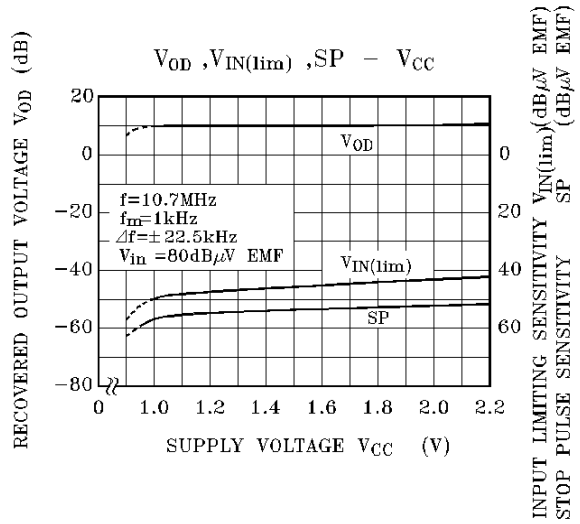
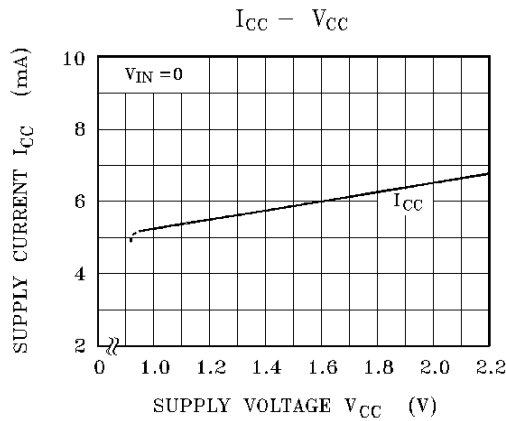
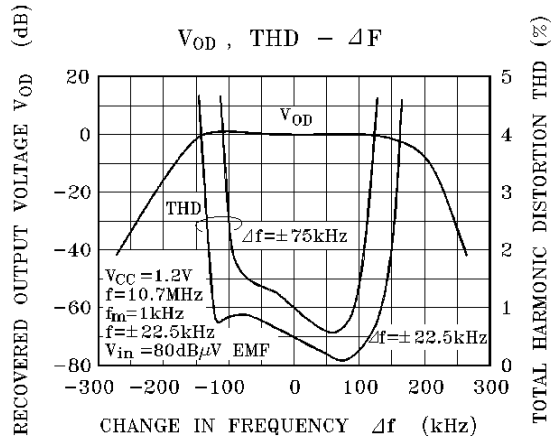
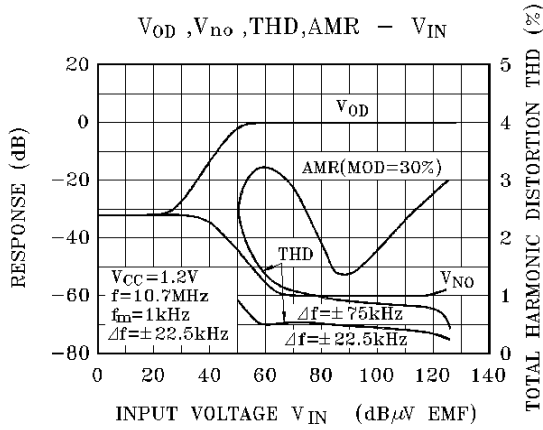
Ⓢ : SUMIDA ELECTRIC Co., Ltd.

TEST CIRCUIT 2



KDV149

FM IF



AM

