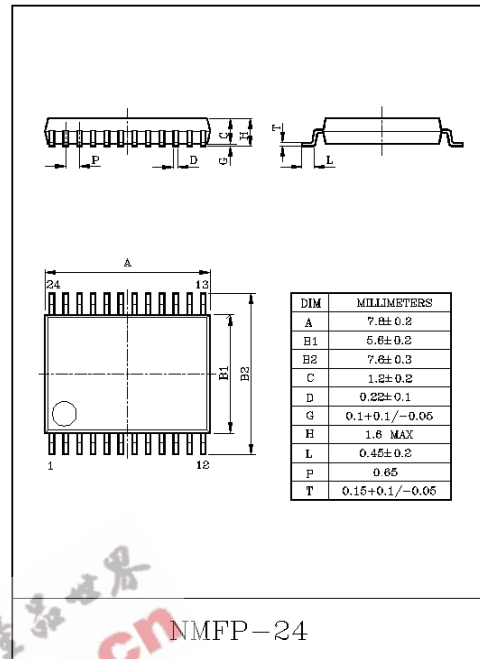


1.5V AM/FM+MPX
(for Digital Tuning System)

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. ($T_a=25^{\circ}\text{C}$)
: $V_{CC(opr)}=0.95\sim 2.2\text{V}$.
- STEREO operating supply voltage range. ($T_a=25^{\circ}\text{C}$)
: $V_{CC(opr)}=1.0\sim 2.2\text{V}$.



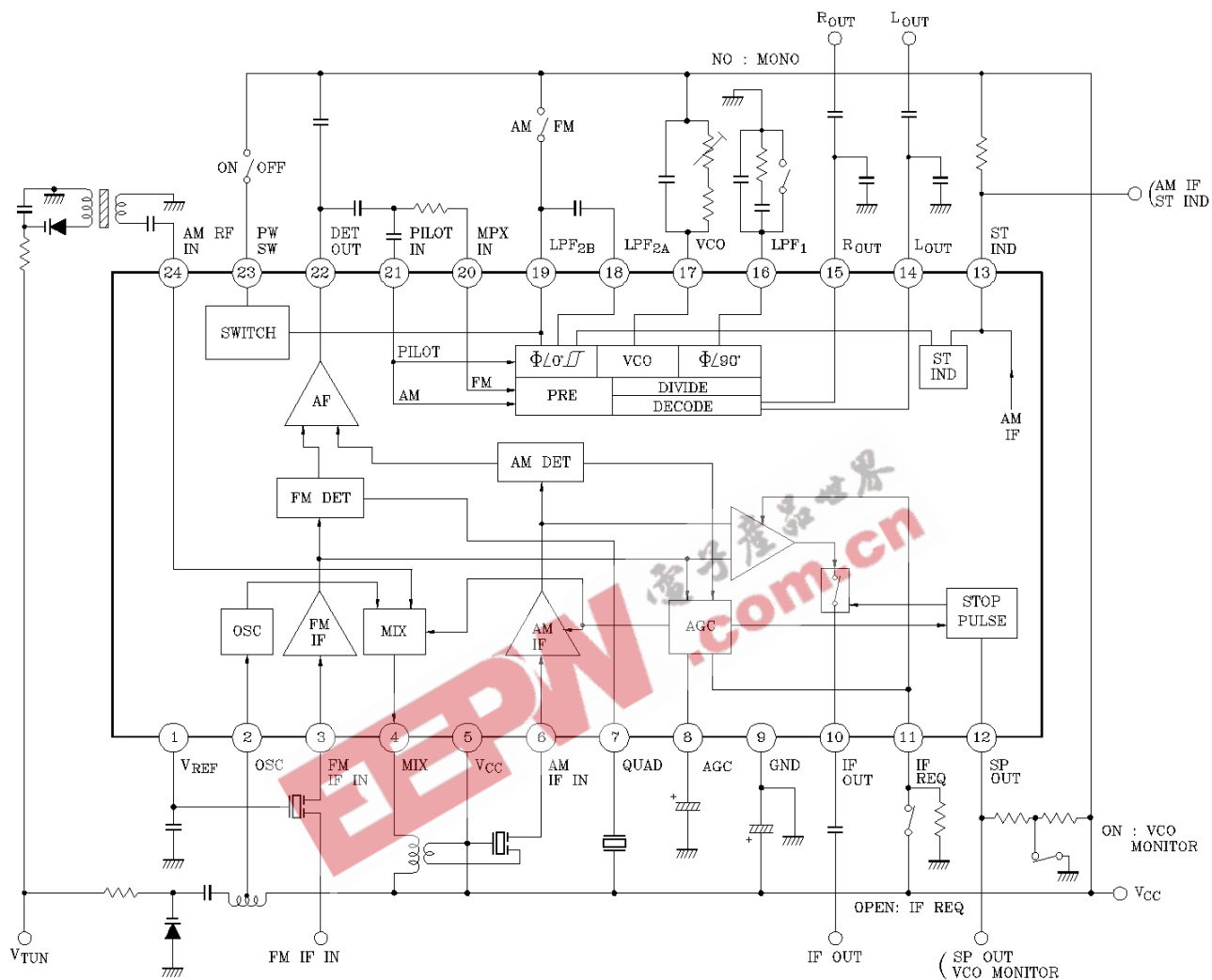
MAXIMUM RATINGS ($T_a=25^{\circ}\text{C}$)

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}	$-25\sim 75$	$^{\circ}\text{C}$
Storage Temperature	T_{stg}	$-55\sim 150$	$^{\circ}\text{C}$

Note) Derated above $T_a=25^{\circ}\text{C}$ in the proportion of $4\text{mW}/^{\circ}\text{C}$.

KIA2022AFN

BLOCK DIAGRAM



KIA2022AFN

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	1	$I_{I2}=0.5mA$, 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

KIA2022AFN

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=90mV _{rms} , P=10mV _{rms}	-	0.3	-		
		AM	THD5		V _{IN} =100mV _{rms}	-	0.2	-		
	Separation		SEP		L+R=90mV _{rms} P=10mV _{rms}	fm=100Hz	-	36	-	dB
						fm=1kHz	25	35	-	
						fm=10kHz	-	34	-	
	Stereo Indicator Sensitivity		ON		ST _(ON)	Pilot Signal Input I ₃ =0.5mA, SW5 : a	-	5.5	8	mV _{rms}
							OFF	ST _(OFF)	2	
	Stereo Indicator Hysteresis		V _H		Stereo Indicator ON/OFF Hysteresis	-	1.5	-	mV _{rms}	
	Capture Range		CR		P=10mV _{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

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

KIA2022AFN

EXPLANATION OF TERMINALS

PIN NO.	TERMINAL NAME	CONTENTS	INTERNAL EQUIVALENT CIRCUIT	DC VOLTAGE (V) (at No Signal)	
				AM	FM
8	AGC	AGC Terminal (AM) AM : Constant of AGC to Decide FM : Level Change of Stop Pulse Signal to Controlled		-	-
9	GND	-	-	0	0
10	IF OUT	IF Count Output FM : $V_{IF(FM)}=80mV_{P-P}$ (Typ.) AM : $V_{IF(AM)}=100mV_{P-P}$ (Typ.)		-	-
11	IF REQ	IF Request Switch [V_{CC} : Receiving Mode Open : IF Request		-	-
12	SP OUT	Stop Pulse Output [ON : VCO monitor OPEN : SP out		-	-
13	ST IND	Stereo Indicator Terminal. • With a AM IF Modulation Output. • AM IF Output : $6mV_{rms}$ ($R_{IF}=3k\Omega$, Typ.)		-	-

KIA2022AFN

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	LPF ₁	LPF Terminal for Phase Detector. V ₁₆ =GND→FM Mono.		-	-
17	VCO	VCO Control Terminal.		-	1.2
18	LPF _{2A}	LPF Terminal for Pilot Detector.		-	-
19	LPF _{2B}	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

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

TEST CIRCUIT 1

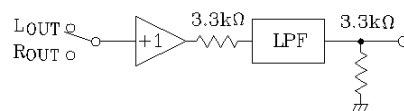
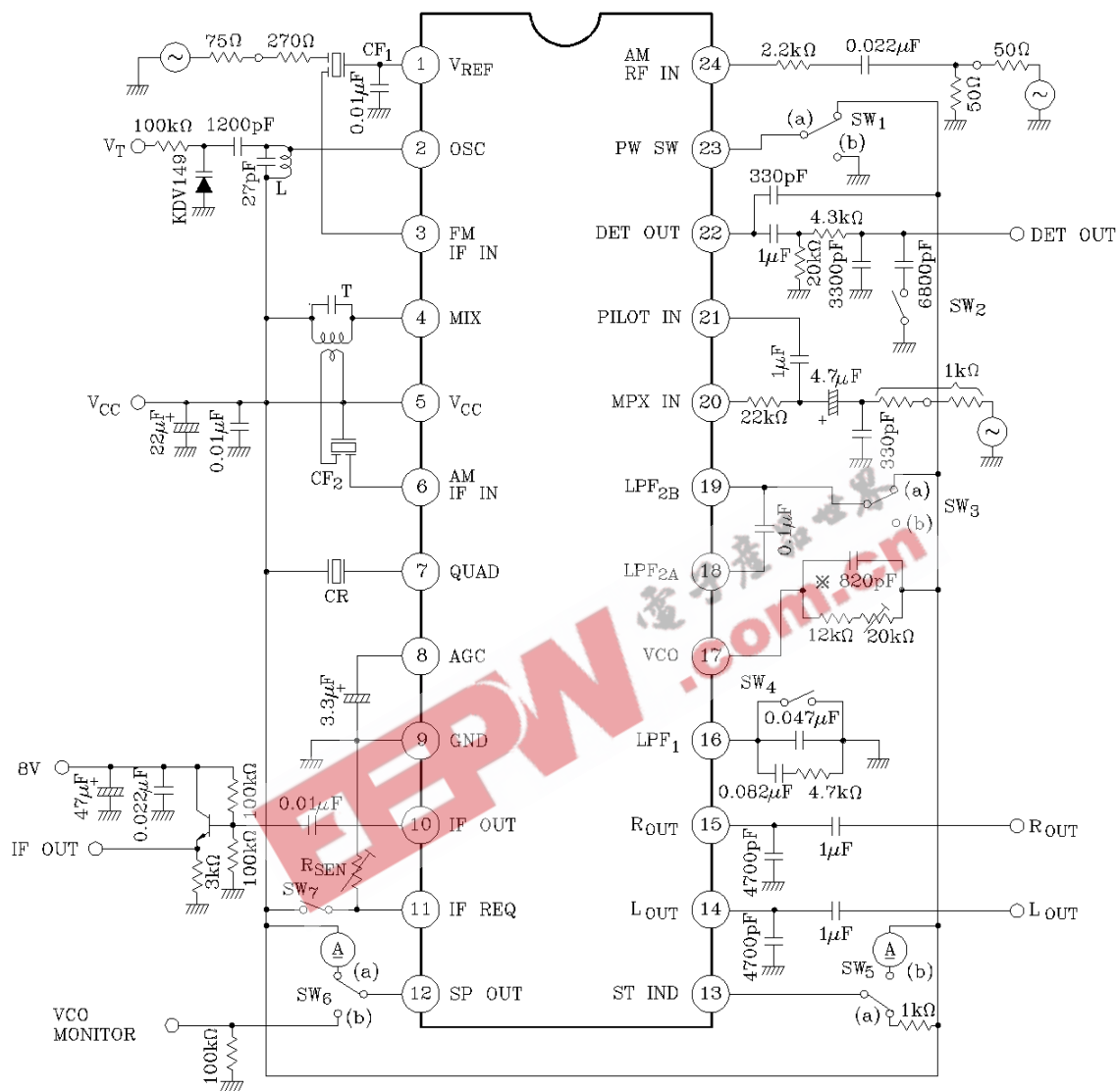


Fig.9 FILTER CIRCUIT

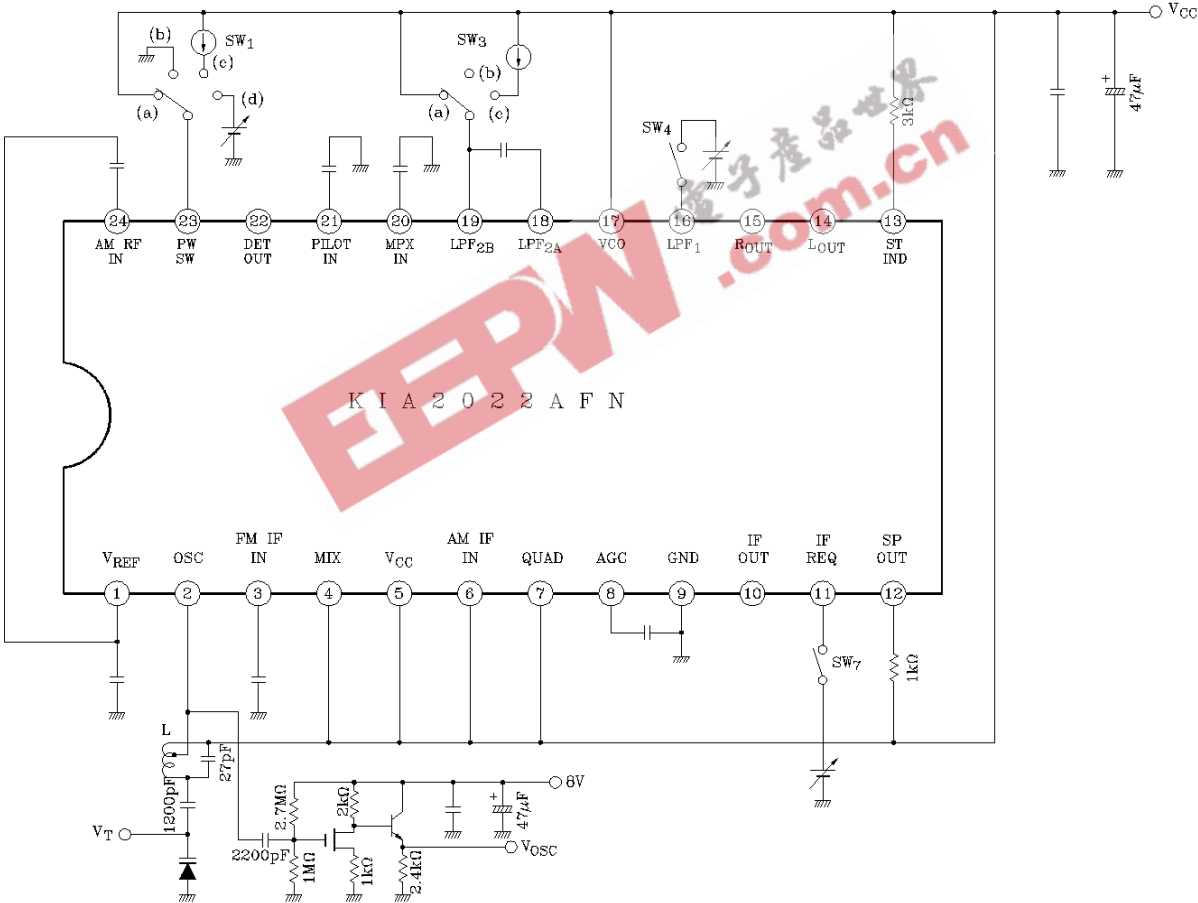
KIA2022AFN

TEST COIL DATA

COIL SYMBOL	TEST FREQUENCY	L (μH)	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	⑤ 4187-144
T AM IFT	450kHz	-	180	65	-	-	184	29	0.05 UEW	⑤ 4161-242

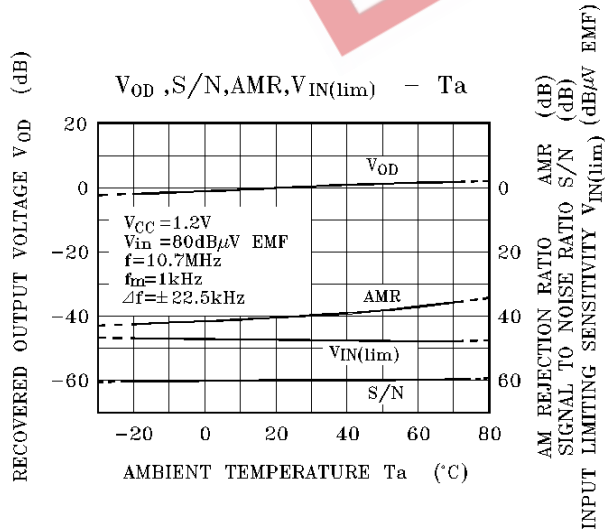
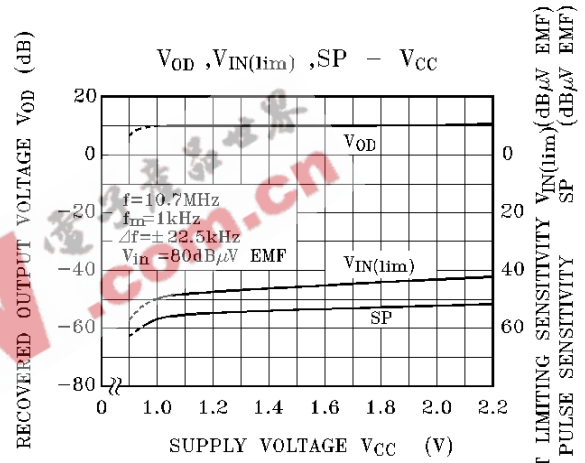
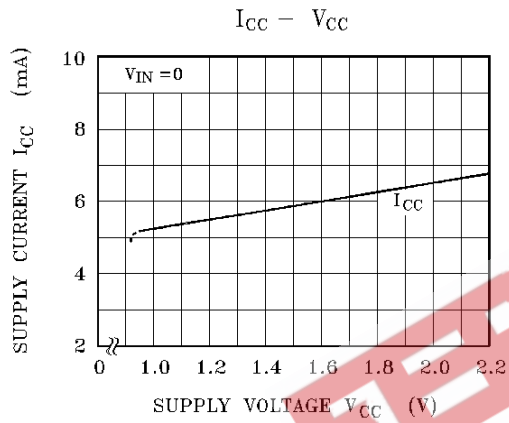
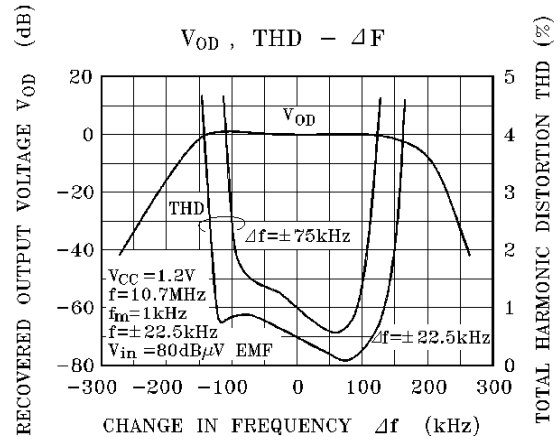
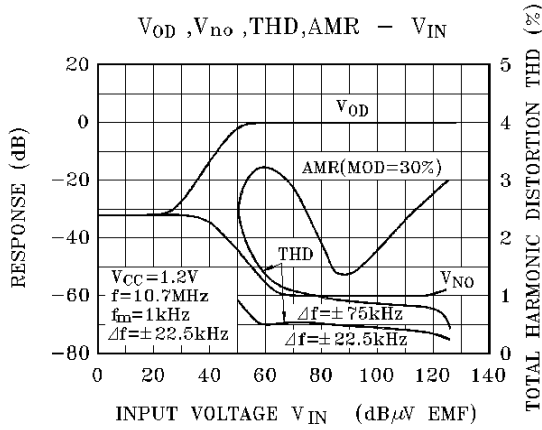
⑤ : SUMIDA ELECTRIC Co., Ltd.

TEST CIRCUIT 2



KDV149

FM IF



AM

