

ADVANCED RF PROCESSOR

KIA2074F is an advanced RF processor for car tuners. An FM front end and AM tuner are internal parts are drastically reduced. Car tuners with both FM/AM require only the KIA2093F post-stage advanced FM processor and KIA2074F to realize a tuner with very high-quality performance.

FEATURES

FM Front End Block

- Balanced Mixer
- Voltage-controlled oscillator (VCO)
- VCO Buffer Output.
- IF Amp
- Advanced narrow linear AGC (NLA)
- Band switching

AM Tuner Block

- Up Conversion Double Super Heterodyne
- Balanced Mixer 1
- Balanced Mixer 2
- VCO with auto level control (ALC)
- VCO Buffer Output
- Oscillator
- IF Amp.
- AM Detection.
- Field strength detection.
- IF Count Output by request, and IF output for AM stereo decoding
- SD Output
- Automatic gain control (AGC)
- IF AGC speed-up
- Operating supply voltage :  $V_{opr}=8\pm 1V$

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

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage	$V_{CC}$	10	V
Power Dissipation (Note)	$P_D$	890	mW
Operating Temperature	$T_{opr}$	-40~85	$^\circ C$
Storage Temperature	$T_{stg}$	-55~150	$^\circ C$
Pin ③ Flow Current	$I_{S1}$	6	mA
Pin ② Applied Voltage	$V_{(Req.)}$	6	V

Note : When using at temperatures higher than  $25^\circ C$ , maximum power dissipation decreases by 7.12mW for every  $1^\circ C$  over  $25^\circ C$ . See Figure 1 for the relationship between the power dissipation and the ambient temperature when using.

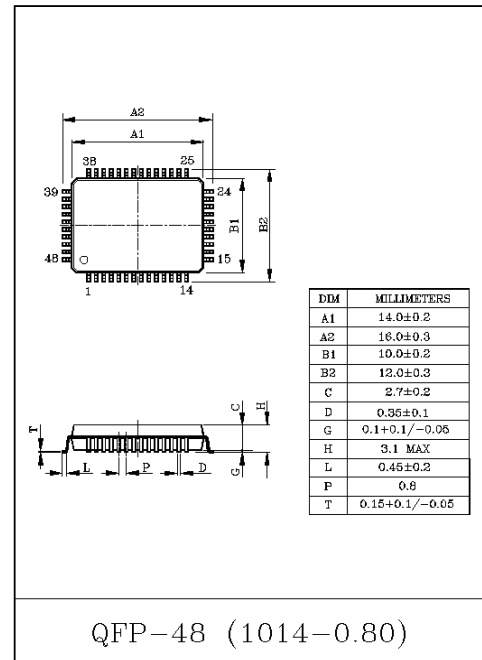
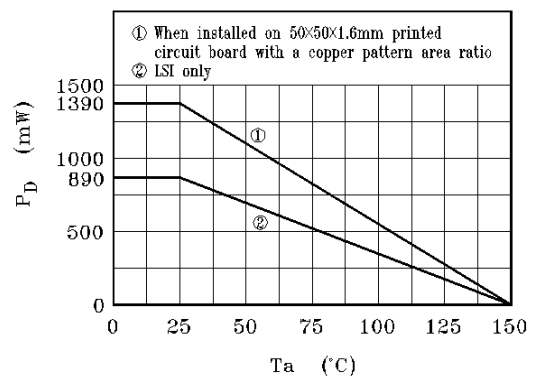


Fig.1 POWER DISSIPATION ( $P_D$ )- OPERATING AMBIENT TEMPERATURE ( $T_a$ )



# KIA2074F

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## FEATURES

### FM Front End Block

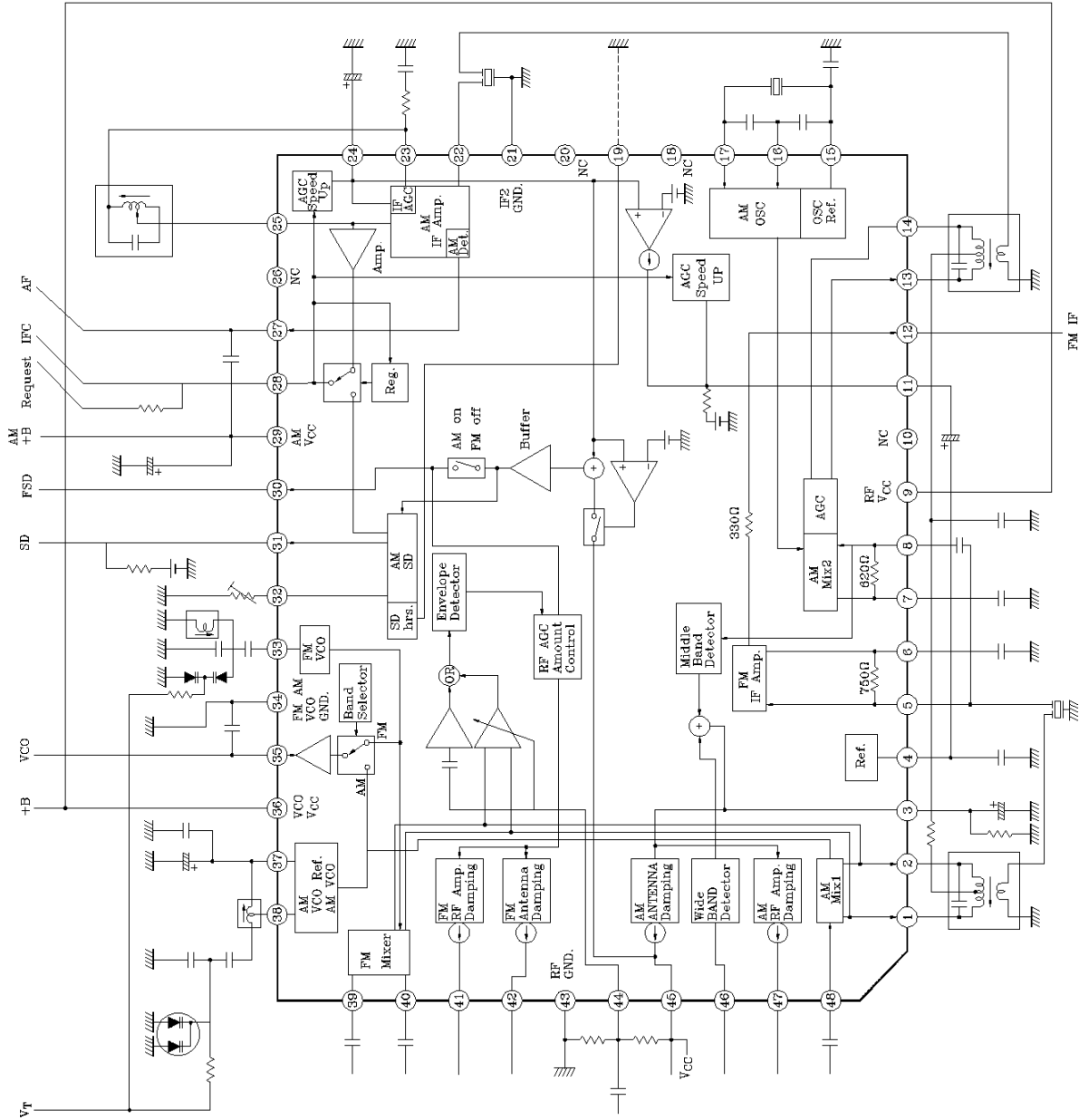
- The Balanced input-type mixers, which do not require a balun coil, offer improved intermodulation distortion while improving total IP by 10dB over the conventional level.
  - : Total IP  $\approx 115\text{dB}\mu\text{V}$  (Typ.) when 3SK195+KIA2074F
  - ... JIS dummy input terminal regulation
  - Replace the varactor with a fixed capacitor of a similar capacitance.
- Expands the IF amp dynamic range and improves AMR and tweet interference characteristics about  $10\text{dB}\mu\text{V}$  above the previous product. Therefore, the RF AGC sensitivity can be set as desired without AMR deterioration.
  - : Field strength where AMR deterioration starts  $\geq 80\text{dB}\mu\text{V}$  (Typ.)
- The pattern and wiring can be designed more freely because the VCO buffer output drivability is improved.
  - : With  $680\Omega/15\text{pF}$  load,  $\approx 110\text{dB}\mu\text{V}$  (Typ.)
- Incorporates an advanced NLA. The NLA uses the signal meter output (a means of detecting the field strength of the target station) to control the synthetic output from the wide AGC detected from the signal in the RF amp bandwidth and the middle AGC detected from the signal in the mixer bandwidth. This improves sensitivity rejection, the result of near-detuning interference, while improving the IM distortion over a wide range up to far-detuning interference.

### AM Tuner Block

- Because of the up conversion, KIA2074F is compatible with LW reception.
- Because of improved cross modulation distortion at balance mixer 1 and 2, and the effective AGC, the overall cross modulation distortion matches the distortion obtained by the down conversion.
  - : S/N  $\approx 20\text{dB}$  (Typ.) when  $V_d=40\text{dB}\mu\text{V}$  EMF,  $V_u=100\text{dB}\mu\text{V}$  EMF,  $\Delta F=400\text{kHz}$
- Although the dynamic range is expanded without a ceramic resonator, the signal meter output operates without malfunction caused by far-detuning interference.
  - : Signal meter output dynamic range  $\approx 90\text{dB}$  (Typ.)
- The noise convergence can be set as desired.
- Supports an SD output pin for memory scan.
- The SD output and the IF count output are synchronized. The detection sensitivity for the field strength can be set anywhere within the signal meter output dynamic range.
- The request function operates at a seek and the IF system supports two types of AGC speed-up. Thus, the response of the distortion ratio, SD output, and IF count output are balanced at both low FM and high AM signal strengths.
  - : THD  $\approx -40\text{dB}$  (Typ.) at 100Hz, 80% AM
  - : SD output and IF count output generation time  $\approx 12\text{ms}$  (Typ.)
- For compatibility with Motorola-type AM stereo reception, the C/N of the AM VCO is improved and the quality of stereo S/N matches the down conversion stereo S/N.
  - : S/N  $\approx 42\text{dB}$  (Typ.) when  $V_d=74\text{dB}\mu\text{V}$  EMF, AM=400Hz/30%
  - :  $f_{CL}=200\text{Hz}$ ,  $-18\text{dB/oct.}$  wiggling
- The VCO buffer output is a single output pin type that is connected to both AM and FM VCOs by switching. External switches are not necessary. As with the FM front end block, pattern and wiring design freedom is improved because of the single output pin and better drivability.
  - : With  $6.8\text{k}\Omega/15\text{pF}$  load  $\approx 110\text{dB}\mu\text{V}$  (Typ.)
- Oscillation tolerance in relation to the crystal oscillator is improved.
  - : With standard crystal, additional series resistance when the mixer gain starts to drop  $\approx 620\Omega$  (Typ.)

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## BLOCK DIAGRAM



# KIA2074F

## PIN NAMES

PIN NO.	PIN SYMBOL	PIN NAME
1	Mixer out 1	Mixer output 1
2	Mixer out 2	Mixer output 2
3	AM RF AGC Trimer	AM RF AGC trimmer
4	FM·AM Reference	FM/AM reference voltage
5	FM IF Amp. in	FM IF amp input
6	FM IF Amp. Bypass	FM IF amp bypass
7	AM 2'nd Mixer Bypass	AM 2'nd Mmixer bypass
8	AM 2'nd Mixer in	AM 2'nd mixer input
9	V <sub>cc1</sub>	V <sub>cc1</sub>
10	NC	
11	AM 2'nd Mixer AGC	AM 2'nd mixer AGC
12	FM IF Amp. out	FM IF amp output
13	AM 2'nd Mixer out 1	AM 2'nd mixer output 1
14	AM 2'nd Mixer out 2	AM 2'nd mixer output 2
15	AM OSC Reference	AM oscillator reference voltage
16	AM OSC·E	AM oscillator feedback
17	AM OSC·B	AM oscillator oscillation
18	NC	
19	NC	
20	NC	
21	Gnd 2	Ground 2
22	AM IF Amp. in	AM IF amp input
23	AM IF NF	AM IF amp NF
24	AM IF AGC	AM IF amp AGC
25	AM Det.	AM detector
26	NC	
27	AM AF	AM detector output
28	AM Request	AM IF count request
29	V <sub>cc2</sub>	V <sub>cc2</sub>
30	AM Meter	AM meter output
31	AM SD out	AM station detector output
32	AM SD Trimer	AM station detector trimmer
33	FM VCO	FM VCO
34	FM·AM VCO Gnd	FM/AM VCO ground
35	VCO out	VCO output
36	VCO V <sub>cc</sub>	V <sub>cc</sub> for VCO
37	AM VCO Reference	AM VCO reference voltage
38	AM VCO	AM VCO
39	FM Mixer in 1	FM mixer input 1
40	FM Mixer in 2	FM mixer input 2
41	FM AGC (FET) out	FM FET damping output
42	FM AGC (PIN) out	FM antenna damping output
43	Gnd. 1	Ground 1
44	FM AGC Trimer	FM AGC trimmer
45	AM AGC (PIN) out	AM antenna damping output
46	AM Wide AGC in	AM wide AGC input
47	AM AGC (FET) out	AM FET damping output
48	AM 1'st Mixer in	AM 1'st mixer input

# KIA2074F

## ELECTRICAL CHARACTERISTICS

FE Block (Unless otherwise specified,  $V_{CC}=V_{CC1}=8.5V$ ,  $V_{CC2}=0V$ ,  $T_a=25^\circ C$ ,  $f_i=98.1MHz$  CW,  
 $V_{IN}=110dB\mu V$ ,  $V_T \approx 3.5V$ ,  $V_{I(NLA)}=5V$ )

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Current With No Signal Input	$I_{CCQ}$	$V_{IN}=-20dB\mu V$	40	50	62	mA
Overall Gain	$G_V$	$G_V = \frac{V_{O(IF)}}{V_{IN}}$ , $V_{IN}=80dB\mu V$	28	31	34	dB
IF Maximum Output	$V_{O(IF)}$	-	113	118	123	dB $\mu V$
VCO Output	$V_{O(VCO \cdot FM)}$	$V_{IN}=80dB\mu V$	103	110	115	
Middle AGC Sensitivity	$V_{S(M,AGC)}$	When $V_{O(Ant.)}=1.5V$	79	83	87	
Wide AGC Sensitivity	$V_{S(W,AGC)}$	$f_i=100.1MHz$ CW	85	89	93	
NLA Sensitivity	$V_{S(NLA)}$	$V_{O(Ant.)}=3.0V$	0.8	1.0	1.2	V
Maximum Antenna Damping Output	$V_{O(Ant.)}$	-	5.0	5.5	6.0	
FET Damping Saturation Output	$V_{OS(FET)}$	-	-	0.1	0.2	

AM Tuner Block (Unless otherwise specified,  $f_d=999kHz$ ,  $V_d=74dB\mu V$  EMF, AM=400Hz 30%,  
 $V_{CC}=V_{CC2}=8.5V$ ,  $T_a=25^\circ C$ ,  $V_T \approx 3V$ )

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Current With No Signal Input	$I_{CCQ}$	$V_d=-20dB\mu V$ EMF	49	59	74	mA
Supply Current	$I_{CC}$	$V_d=130dB\mu V$ EMF CW				
Detection Output	Signal	-	150	180	210	mV <sub>rms</sub>
Signal to Noise Ratio	S/N	AM=400Hz 30%→0%	49	54	-	dB
Full Harmonic Distortion Ratio	THD1	-	-	-50	-43	dB
				(0.32)	(0.71)	%
	THD2	AM=400Hz 80%	-	-44	-	dB
				(0.63)	-	%
	THD3	$V_d=130dB\mu V$ EMF	AM=400Hz 80%	-	-41	-34
			(0.89)	(2.0)	%	
	THD4	AM=100Hz 80%	-	-27	-	dB
			(4.47)	-	%	
Meter Output	$V_{M1}$	$V_d=40dB\mu V$ EMF	0.6	1.1	1.6	V
	$V_{M2}$	$V_d=80dB\mu V$ EMF	2.2	2.8	3.4	
	$V_{M3}$	$V_d=120dB\mu V$ EMF	5.9	6.2	6.5	
Request Threshold	$V_{th(Req.)}$	When $V_{O(IFC)}=106dB\mu V$	0.9	1.2	1.5	
SD Sensitivity	$V_{S(SD)}$	$V_{O(SD)}=V_{CC}$	30	35	40	dB $\mu V$ EMF
IF Count Output	$V_{O(IFC)}$	$V_{(Req.)}=0V$	103	106	109	dB $\mu V$ EMF
IF Output	$V_{O(IF)}$	$V_{(Req.)} \rightarrow 5.0V$	103	106	109	
VCO Output	$V_{O(VCO \cdot AM)}$	-	104	109	114	
Usable Sensitivity	US	S/N=20dB, AM=400Hz, 30%→0%	-	26	-	dB $\mu V$ EMF
Max Sensitivity	MS	Signal=-10dB	-	22	-	
Noise Convergence	NC	0dB=Signal, $V_d=74 \rightarrow -20dB\mu V$ EMF	-	-43	-	dB



# KIA2074F

## DESCRIPTION OF PIN FUNCTIONS

(Pin voltage are typical values when,  $V_{CC}=8.5V$ ,  $T_a=25^{\circ}C$  test circuit, no AC signal)

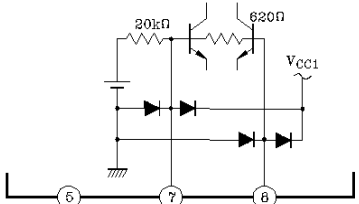
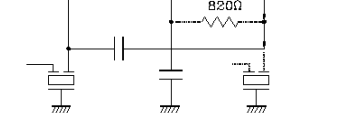
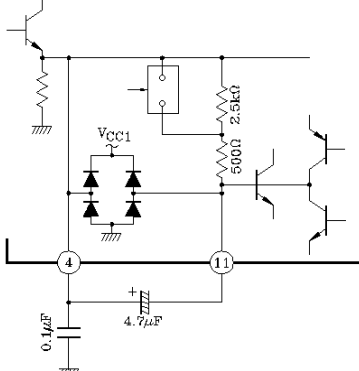
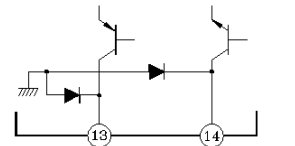
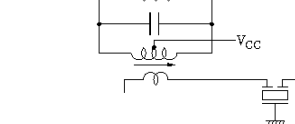
PIN No.	PIN NAME	PIN VOLTAGE (V) FM/AM	INTERNAL EQUIVALENT CIRCUIT/ INTERNAL STANDARD VALUE (INTERNAL R, C TYPICAL VALUES)	PIN FUNCTION
1	Mixer out 1	8.5/8.5		FM Mixer and AM 1'st Mixer output pin Externally connect a 10.7MHz IFT (eg. Toko 7KL-1021) and a common AM/FM ceramic filter. At FM reception, the AM 1'st mixer is disabled. At AM reception, the FM mixer is disabled.
2	Mixer out 2	8.5/8.5		FM mixer input pin. Externally connect an RF tuning coil or similar by capacitive coupling.
39	FM Mixer in 1	1.0/0		AM 1'st mixer input pin. Externally connect an RF amp.
40	FM Mixer in 2	1.0/0		
48	AM 1'st Mixer in	0/3		
4 5 7	FM·AM Reference	4.2/5.8		Common reference voltage supply for the AM and FM blocks Externally connect a capacitor.

# KIA2074F

PIN No.	PIN NAME	PIN VOLTAGE (V) FM/AM	INTERNAL EQUIVALENT CIRCUIT/ INTERNAL STANDARD VALUE (INTERNAL R, C TYPICAL VALUES)	PIN FUNCTION
5	FM IF Amp. in	2/0		FM IF amp input pin. Externally connect a ceramic filter. If the dedicated 1'st ceramic filters are used for FM and AM, externally connect a 680Ω-matching resistor between this pin and pin 6.
6	FM IF Amp. Bypass	2/0		FM IF amp input bypass pin. Externally connect a capacitor to the external ceramic filter grounding point.
12	FM IF Amp. out	3.2/7.7		FM IF output pin. Externally connect a ceramic filter.
3	AM RF AGC Trimer	0/0.1		AM RF AGC smoothing and sensitivity setting pin Externally connect a capacitor and resistor. The higher the resistance the higher the RF AGC sensitivity. Starts operating at around 0.7V. When setting the time constant of the capacitor and resistor, set in accordance with such factors as the strong field distortion and attack recovery time.
9	V <sub>CC1</sub>	8.5/8.5	-	Power line for the FM block NLA and IF amp, and for the AM block 1'st mixer, 2'nd mixer, and oscillator.



# KIA2074F

PIN No.	PIN NAME	PIN VOLTAGE (V) FM/AM	INTERNAL EQUIVALENT CIRCUIT/ INTERNAL STANDARD VALUE (INTERNAL R, C TYPICAL VALUES)	PIN FUNCTION
7	AM 2'nd Mixer Bypass	0/3.5		AM 2'nd Mixer input bypass pin. Externally connect a capacitor to the external ceramic filter grounding point.
8	AM 2'nd Mixer in	0/3.5		AM 2'nd mixer input pin. Externally connect a ceramic filter.
11	AM 2'nd Mixer AGC	0/4.8		AM 2'nd mixer AGC smoothing pin. Shortens the time constant at a seek. Externally connect a capacitor between this pin and pin 4.
13	AM 2'nd Mixer out 1	8.5/8.5		AM 2'nd mixer output pin. Externally connect a 450kHz IFT and damping resistor.
14	AM 2'nd Mixer out 2	8.5/8.5		AM 2'nd mixer output pin. Externally connect a 450kHz IFT and damping resistor.

# KIA2074F

PIN No.	PIN NAME	PIN VOLTAGE (V) FM/AM	INTERNAL EQUIVALENT CIRCUIT/ INTERNAL STANDARD VALUE (INTERNAL R, C TYPICAL VALUES)	FUNCTION
15	AM OSC Reference	0/4.7		AM oscillator reference voltage supply. Externally connect a capacitor.
16	AM OSC·E	0/2.5		AM oscillator feedback pin. Externally connect a capacitor.
17	AM OSC·B	0/3.2		AM oscillator pin. Externally connect a kinseki HC-47/U-S crystal and a capacitor for positive feedback.
21	Gnd. 2	0/0		Ground line for the 2'nd mixer, oscillator, IF amp, detector, meter, SD, and reference power supply.

# KIA2074F

PIN No.	PIN NAME	PIN VOLTAGE (V) FM/AM	INTERNAL EQUIVALENT CIRCUIT/ INTERNAL STANDARD VALUE (INTERNAL R, C TYPICAL VALUES)	FUNCTION
22	AM IF Amp. in	0/3.6		AM IF amp input pin. Externally connect a ceramic filter.
23	AM IF NF	0/3.6		AM IF amp NF pin. Externally connect a capacitor, one end of a 450kHz coil, and a resistor for setting the noise convergence. The higher the resistance the lower the convergence.
24	AM IF AGC	0/2.1		AM IF amp AGC smoothing pin. Shortens the time constant at a seek. Externally connect a capacitor.
25	AM Det.	0/3.6		AM detector bandwidth setting pin. Externally connect a 450kHz coil.
27	AM AF	0/2.1		AM detector output pin. Externally connect a capacitor and resistor for detection. Output goes to the AM distributor input pin of the post-stage FM processor KIA2093F.
29	V <sub>CC2</sub>	0/8.5		Power supply pin for the AM IF block and band switching pin. When set high, switches to AM. When set low, switches to FM. Externally connect a capacitor.
30	AM Meter	0/0		AM meter output pin. Directly connected to pin 35, the meter output pin of the post-stage FM processor KIA2093F. Enables AM/FM meter output on the same pin. When set to FM, operates as NLA input pin and uses the metr output signal from the FM processor to control the RF AGC output level. When using the KIA2074F independently, externally connect a 10kΩ resistor to pin 30.

# KIA2074F

PIN No.	PIN NAME	PIN VOLTAGE (V) FM/AM	INTERNAL EQUIVALENT CIRCUIT/ INTERNAL STANDARD VALUE (INTERNAL R, C TYPICAL VALUES)	PIN FUNCTION
28	AM Request	0/0 or 5		<p>AM IF count output request pin. Pulling this pin down below 2.0V requests the IF count output and the stop pulse output, and shortens the 2'nd mixer AGC and IF AGC time constants.</p> <p>However, the IF count and the stop pulse are not output when the input field strength is lower than the seek sensitivity.</p> <p>Pulling this pin up to over 2.0V obtains an IF output of 106dBμV for the AM stereo decoder (eg, Motorola Japan MC 13020VM) and allows a direct connection through an external capacitor.</p>
31	AM SD out	8.5/8.5		<p>AM station detector stop pulse output pin. Externally connect a pull-up resistor of at least 10kΩ. For operating principles, see the descriptions for pins 28 and 32.</p>
32	AM SD Trimer	0/1		<p>Seek sensitivity setting pin for the AM station detector. Externally connect a variable resistor. If meter output exceeds the voltage set to this pin (pin 30 voltage), the IF count output and the SD output are held in wait state.</p>

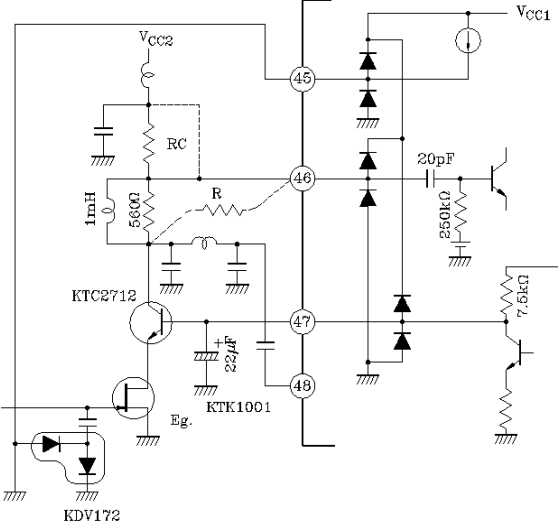
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PIN No.	PIN NAME	PIN VOLTAGE (V) FM/AM	INTERNAL EQUIVALENT CIRCUIT/ INTERNAL STANDARD VALUE (INTERNAL R, C TYPICAL VALUES)	FUNCTION
33	FM VCO	2.4/0.4		FM VCO oscillator pin. Externally connect an oscillation coil.
34	FM·AM VCO Gnd	0/0		FM and AM VCO ground pin.
35	VCO out	5.9/5.9		FM and AM VCO buffer ground pin.
36	VCO V <sub>cc</sub>	8.5/8.5		FM and AM VCO output pin.
37	AM VCO Reference	0/5.7		FM VCO, AM VCO, and VCO buffer power supply pin. Externally connet capacitor.
38	AM VCO	0/5.7		AM VCO oscillator pin. Externally connect an oscillator coil.

# KIA2074F

PIN No.	PIN NAME	PIN VOLTAGE (V) FM/AM	INTERNAL EQUIVALENT CIRCUIT/ INTERNAL STANDARD VALUE (INTERNAL R, C TYPICAL VALUES)	PIN FUNCTION
41	FM AGC (FET) out	6.7/6.7		FET damping output pin. Externally connect a pull-up resistor of at least 22kΩ, a capacitor, and J-MOS FET (eg, 3SK126). The FET damping starts at the same time as antenna damping using the PIN diode.
42	FM AGC (PIN) out	0.2/0.3		Drive pin for the FM antenna damping PIN diode (eg, 15V172) for current amplification, externally connect a 2SC2712GR or equivalent transistor. For smoothing, connect a capacitor. This FM damping starts at the same time as the FET damping.
43	Gnd. 1.	0/0		Ground line for the FM NLA, FM ref, FM IF amp 1, AM 1'st mixer, and AM RF AGC.
44	FM AGC Trimer	0/0		RF AGC wide bandwidth input pin for RF signal. Set the sensitivity by the external capacitor value. The lower the capacitance the lower the operating sensitivity. AGC starts operating when this pin exceeds around 83dBμV. This pin also sets, by the DC voltage level, the middle bandwidth AGC operating sensitivity detected by the mixer output pin. The operating sensitivity is set by the divisor ratio of the external resistor connected between the Vcc and GND. When the level of this pin is around 0V, the sensitivity is maximum; at around Vcc, the sensitivity is minimum. The resistor connected between this pin and GND should be 100kΩ or below.

# KIA2074F

PIN No.	PIN NAME	PIN VOLTAGE (V) FM/AM	INTERNAL EQUIVALENT CIRCUIT/ INTERNAL STANDARD VALUE (INTERNAL R, C TYPICAL VALUES)	PIN FUNCTION
45	AM AGC (PIN) out	0.2/0.3		<p>Drive pin for the AM antenna damping PIN diode (eg, 15V172). The maximum output current is <math>1400\mu\text{A}</math> (Typ.). Wide bandwidth AGC input pin for inputting RF signal.</p>
46	AM Wide AGC in	0/-		<p>Directly connected to the RC on the collector side of the J-FET cascade transistor. AGC starts when this pin reaches around <math>108\text{dB}\mu\text{V}</math>. The AGC sensitivity can be lowered by reducing the above-mentioned RC value. Conversely, to raise the sensitivity, connect this pin to the collector of the cascade transistor and connect a resistor between this pin (46) and pin 47. (Because when the resistance or capacitance is increased the cascade transistor is set in the direction of saturation.)</p>
47	AM AGC (FET) out	0/4.7		<p>The J-FET (eg, 2SK1001) damping output pin. Externally connect a 2SC2712GR or equivalent J-FET. For smoothing, connect a capacitor. The AGC sensitivity is set to the same level as the antenna damping.</p>





# KIA2074F

## APPLICATION CIRCUIT

