

## LOG AMPLIFIER

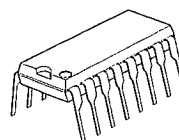
## ■ GENERAL DESCRIPTION

The NJM2204A is an integrated IF limiting amplifier which contains temperature compensated reference power supply, 6 stage differential limiting amplifier and 6 stage logarithmic suppression circuit.

Its voltage gain is 58dB and linearity is  $\pm 1\text{dB}$  within 50dB log dynamic range. The voltage gain and log dynamic range are enlarged by connecting multiple stages.

The NJM2204A is suitable to telecommunication equipment.

## ■ PACKAGE OUTLINE



NJM2204AD

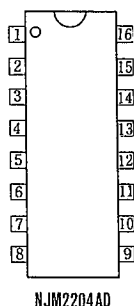
## ■ FEATURES

- Wide log dynamic range (50dB)
- Wide linearity range ( $\pm 1\text{dB}$ )
- Large Voltage Gain (60dB)
- Wide stable operating supply voltage range (8 ~ 12V)
- Wide stable operating temperature range ( $-20 \sim 85^\circ\text{C}$ )
- Package Outline DIP16
- Bipolar Technology

## ■ APPLICATION

- Cellular
- Personal wireless Radio
- Business wireless Radio
- Handy talky

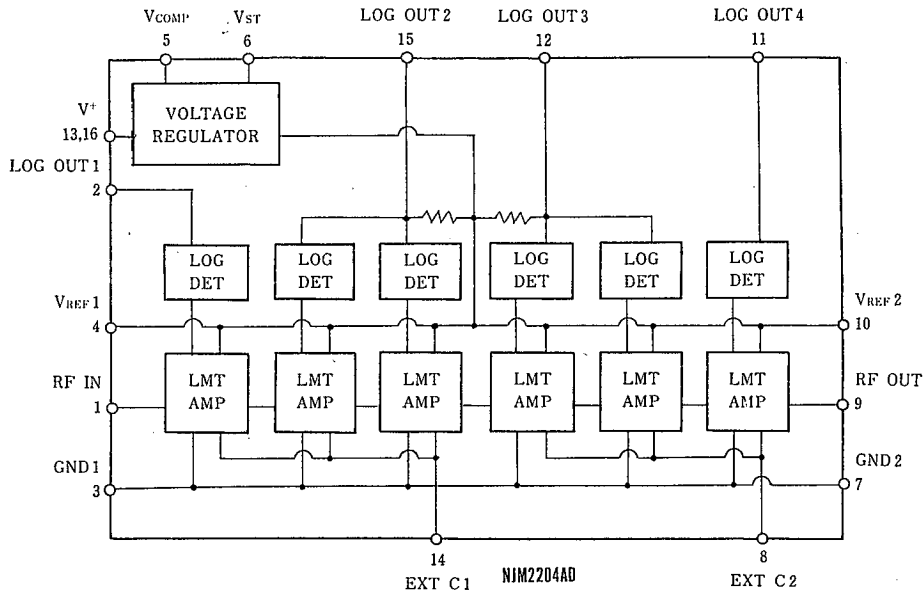
## ■ PIN CONFIGURATION



NJM2204AD

Pin No.	Pin Name	Function
1	RF IN	AC Signal Input (C-coupling)
2	LOG OUT 1	LOG Detector Output (from 1st stage)
3	GND 1	Ground 1
4	V <sub>REF</sub> 1	Internal Reference Voltage 1
5	V <sub>COMP</sub>	Compensation Input to Reference Voltage
6	V <sub>st</sub>	Compensated Output of Reference Voltage
7	GND 2	Ground 2
8	EXT C2	Terminate with C
9	RF OUT	Limited AC Output
10	V <sub>REF</sub> 2	Internal Reference Voltage 2
11	LOG OUT 4	LOG Detector Output (from 6th stage)
12	LOG OUT 3	LOG Detector Output (from 4th and 5th stage)
13	V <sup>+</sup> 2	Supply Voltage Input 2
14	EXT C1	Terminate with C
15	LOG OUT 2	LOG Detector Output (from 2nd and 3rd stage)
16	V <sup>+</sup> 1	Supply Voltage Input 1

## ■ BLOCK DIAGRAM



## ■ LOG DETECTOR OUTPUT CHARACTERISTICS (EXAMPLE)

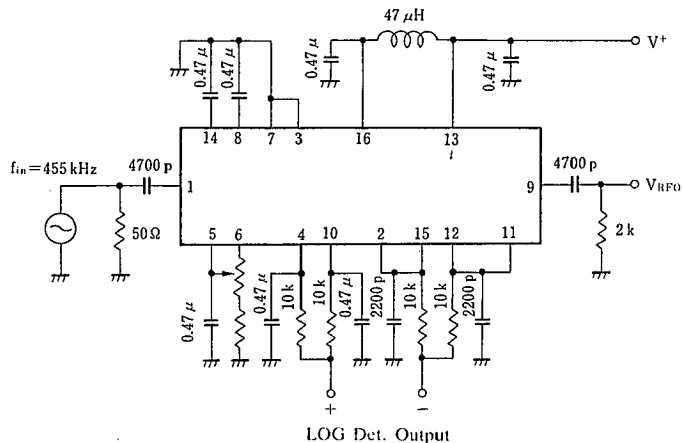
( $T_a=25^\circ\text{C}$ ,  $V^+=9\text{V}$ ,  $V_{\text{REF}}=6.0\text{V}$ )

PARAMETER	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Log Detector Output	$f_{\text{in}}=455\text{kHz}$ , $V_{\text{in}}=8\text{dB}$ (50 $\Omega$ termination)	0.976	1.004	1.032	V
	$f_{\text{in}}=455\text{kHz}$ , $V_{\text{in}}=-2\text{dB}$ (50 $\Omega$ termination)	0.868	0.896	0.924	V
	$f_{\text{in}}=455\text{kHz}$ , $V_{\text{in}}=-12\text{dB}$ (50 $\Omega$ termination)	0.727	0.755	0.783	V
	$f_{\text{in}}=455\text{kHz}$ , $V_{\text{in}}=-22\text{dB}$ (50 $\Omega$ termination)	0.586	0.614	0.642	V
	$f_{\text{in}}=455\text{kHz}$ , $V_{\text{in}}=-32\text{dB}$ (50 $\Omega$ termination)	0.446	0.474	0.502	V
	$f_{\text{in}}=455\text{kHz}$ , $V_{\text{in}}=-42\text{dB}$ (50 $\Omega$ termination)	0.305	0.333	0.361	V
	$f_{\text{in}}=455\text{kHz}$ , $V_{\text{in}}=-52\text{dB}$ (50 $\Omega$ termination)	0.164	0.192	0.202	V
	$f_{\text{in}}=455\text{kHz}$ , $V_{\text{in}}=-62\text{dB}$ (50 $\Omega$ termination)	0.057	0.085	0.113	V
Log Detector Linearity	$T_a=-20^\circ\text{C}\sim 85^\circ\text{C}$ , $V_{\text{in}}=-2\sim -52\text{dBm}$	—	—	$\pm 1$	dB

\* Log Detection Linearity: It is error between RF input level and ideal input level to straight line connected two detection output points of two input level ( $-2\text{dBm}$ ,  $-52\text{dBm}$ ).

\* Temperature coefficient of Log detection output voltage: approximately  $90\mu\text{V}/^\circ\text{C}$  Typ. ( $-20\sim +85^\circ\text{C}$ ).

## ■ TEST CIRCUIT



## RECOMMENDED OPERATING CONDITION

(Ta = -20~85°C)

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
Operating Voltage	V <sup>+</sup>	8.0	9.0	16.0	V
Output Load Impedance	B <sub>RFO</sub>	1	2	—	kΩ
	B <sub>LOGO</sub>	100	—	—	kΩ
Stabilized Voltage	V <sub>VR</sub>	—	6.0	—	V

## ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	V <sup>+</sup>	-0.5~16.0	V
Input Voltage	V <sub>IN</sub>	-0.5~V <sup>+</sup>	V
Output Current	I <sub>LR</sub>	5	mA
	I <sub>RFO</sub>	2	mA
Operating Temperature	T <sub>opr</sub>	-20~85	°C
Storage Temperature	T <sub>stg</sub>	-55~125	°C

(note): The NJM2204A is produced by high frequency wafer process and so destructive voltage against surge pulse is lower than low frequency product.

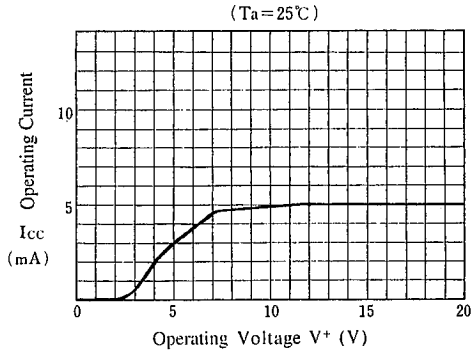
## ELECTRICAL CHARACTERISTICS

(Ta = 25°C, V<sup>+</sup> = 9V, V<sub>REF</sub> = 6.0V)

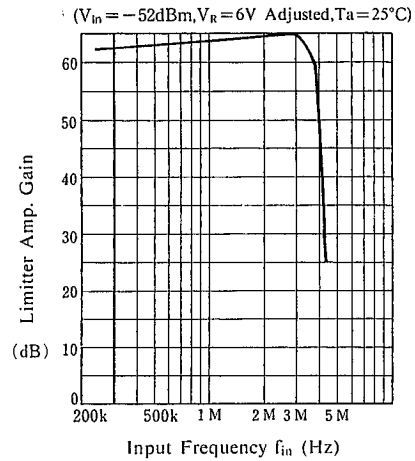
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Current	I <sub>CC</sub>		—	6	10.0	mA
Maximum Operating Frequency	f <sub>max</sub>		0.5	3	—	MHz
Output Voltage Swing	V <sub>RFO</sub>	Input: +8dBm (50Ω termination)	—	2.0	—	V <sub>P-P</sub>
Log Detection Output	V <sub>LOG</sub>	Input: +8dBm (50Ω termination)	—	1.0	—	V
Log Detection Linearity	L <sub>IN</sub>	V <sub>in</sub> = -2dBm ~ -52dBm (50Ω termination)	—	—	±1	dB
Limiter Amp Gain	G <sub>V</sub>		60	—	—	dB

## TYPICAL CHARACTERISTICS

### Operating Current vs. Operating Voltage

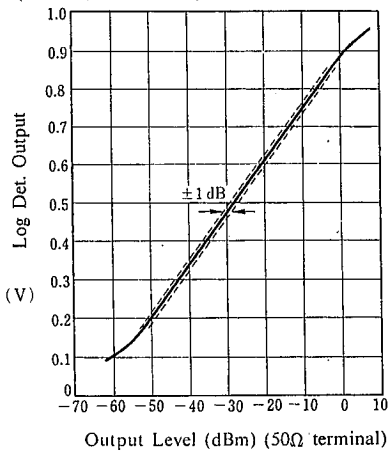


### Limiter Amp Gain



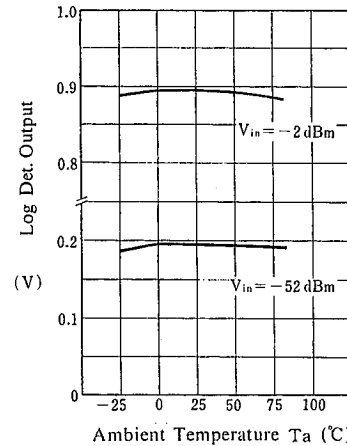
### Log Detector Output

( $V^+ = 9\text{V}$ ,  $V_R = 6\text{V}$  Adjusted,  $f_{in} = 455\text{kHz}$ ,  $T_a = 25^\circ\text{C}$ )



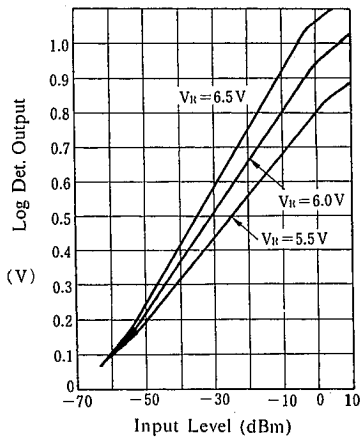
### Log Detector Output

( $V_{in} = -52\text{dBm}$ ,  $V_R = 6\text{V}$  Adjusted,  $T_a = 25^\circ\text{C}$ )



### Log Detector Output $V_R$

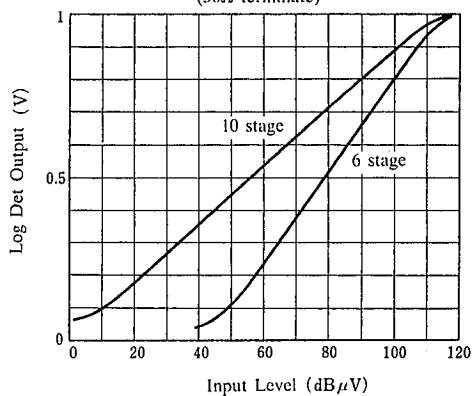
( $f_{in} = 455\text{kHz}$ ,  $T_a = 25^\circ\text{C}$ ,  $50\Omega$  Terminal)



## ■ TYPICAL APPLICATION & CHARACTERISTICS (10 synthesized stage)



**Log Det Output Voltage**  
(50Ω terminate)



## MEMO

**[CAUTION]**

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