



■ GENERAL DESCRIPTION

The NJM1496 is a double balanced modulator-demodulator which produces an output voltage proportional to the product of an input (signal) voltage and a switching (carrier) signal. Typical applications include suppressed carrier modulation, amplitude modulation, synchronous detection, FM or PM detection, broadband frequency doubling and chopping.

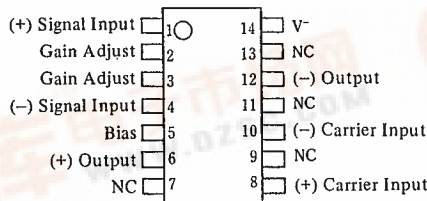
■ FEATURES

- Excellent carrier suppression  
65dB typical at 0.5MHz  
50 dB typical at 10MHz
- Adjustable gain and signal handling
- Fully balanced inputs and outputs
- High Common Mode Rejection 85dB Typ.
- Package Outline DIP14, DMP14, SSOP14
- Bipolar Technology

■ APPLICATION

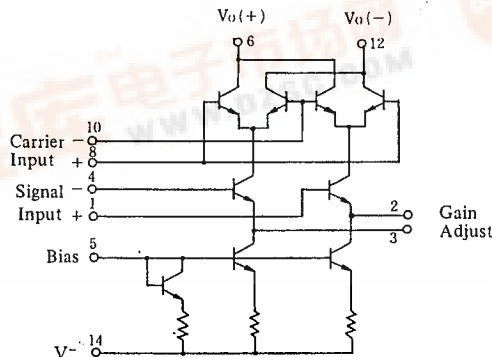
- Balanced Modulation
- Synchronous Detection
- FM Detection
- Phase Detection
- Sampling

■ PIN CONFIGURATION

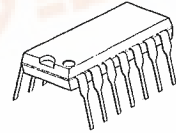


NJM1496D  
NJM1496M  
NJM1496V

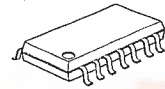
■ EQUIVALENT CIRCUIT



■ PACKAGE OUTLINE



NJM1496D



NJM1496M



NJM1496V



# NJM1496

## ■ ABSOLUTE MAXIMUM RATINGS

(Ta=25°C)

PARAMETER	RATINGS	UNIT
Applied Voltage	30(Applied Pins 6-8, 12-8, 6-10, 12-10, 10-1, 8-1, 10-4, 8-4, 2-5, 3-5)	V
Carrier Input Voltage	±5(Applied Pins 8-10)	V
Signal Input Voltage	±(5+I <sub>s</sub> , Re) (Applied Pins 1-4)	V
Input Signal	5	V
Bias Current (I <sub>s</sub> )	10	mA
Power Dissipation	(DIP14) 570	mW
	(DMP14) 300	mW
	(SSOP14) 300	mW
Operating Temperature Range	-20 ~ +75	°C
Storage Temperature Range	-40 ~ +125	°C

## ■ ELECTRICAL CHARACTERISTICS

DC Characteristics (V<sup>+</sup>=12V, V<sup>-</sup>=-8V, I<sub>s</sub>=1.0mA, R<sub>L</sub>=3.9kΩ, R<sub>e</sub>=1.0kΩ, Ta=25°C)

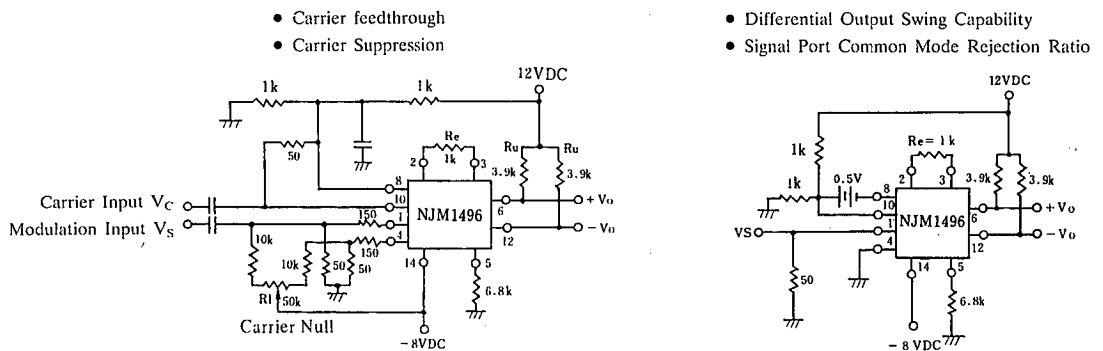
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Single-Ended Input Impedance						
Parallel Input Resistance	R <sub>ip</sub>	Signal Port, f=5.0MHz	—	200	—	kΩ
Parallel Input Capacitance	C <sub>ip</sub>	Signal Port, f=5.0MHz	—	2.0	—	pF
Single-Ended Output Impedance						
Parallel Output Resistance	R <sub>op</sub>	f=10MHz	—	40	—	kΩ
Parallel Output Capacitance	C <sub>op</sub>	f=10MHz	—	5.0	—	pF
Input Bias Current						
I <sub>bs</sub> = I <sub>1</sub> + I <sub>4</sub> /2	I <sub>bs</sub>		—	12	30	μA
I <sub>bc</sub> = I <sub>8</sub> + I <sub>10</sub> /2	I <sub>bc</sub>		—	12	30	μA
Input Offset Current						
I <sub>ios</sub> = I <sub>1</sub> - I <sub>4</sub>	I <sub>ios</sub>		—	0.7	7	μA
I <sub>ioe</sub> = I <sub>8</sub> - I <sub>10</sub>	I <sub>ioe</sub>		—	0.7	7	μA
Average Temperature Coefficient of Input Offset Current	ΔI <sub>io</sub>		—	2.0	—	nA/°C
Output Offset Current (I <sub>6</sub> - I <sub>12</sub> )	I <sub>oe</sub>		—	15	80	μA
Average Temperature Coefficient of Output Offset Current	ΔI <sub>oe</sub>		—	90	—	nA/°C
Output Voltage	V <sub>o</sub>		—	8.0	—	V
Operating Current						
(I <sub>6</sub> + I <sub>12</sub> )	I <sub>D+</sub>		—	2.0	4.0	mA
I <sub>14</sub>	I <sub>D-</sub>		—	3.0	5.0	mA
DC Power Dissipation	P <sub>D</sub>		—	33	—	mW

■ **ELECTRICAL CHARACTERISTICS** AC Characteristics ( $V^+=12V$ ,  $V^-=-8V$ ,  $I_s=1.0mA$ ,  $R_L=2.9k\Omega$ ,  $R_e=1.0k\Omega$ ,  $T_a=25^\circ C$ )

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Carrier Feedthrough	$V_{CFI}$	$V_c = 60mV_{rms}$ sine wave offset adjusted	—	40	—	$\mu V_{rms}$	
		$f_c = 1.0kHz$	—	140	—	$\mu V_{rms}$	
		$V_c = 300mV_{p-p}$ square wave $f_c = 1.0kHz$	—	—	—	—	—
		offset adjusted	—	0.04	0.4	$mV_{rms}$	
Carrier Suppression	$V_{CSI}$	$f_s = 10kHz$ , $300mV_{rms}$ sine wave offset adjusted	—	20	200	$mV_{rms}$	
		$f_c = 500kHz$ , $60mV_{rms}$ sine wave	40	65	—	dB	
		$f_c = 10MHz$ , $60mV_{rms}$ sine wave	—	50	—	dB	
Transmittance Bandwidth ( $R_L = 50\Omega$ )	BW 3dB	$V_c = 60mV_{rms}$ sine wave $f_s = 1.0kHz$ , $300mV_{rms}$ sine wave	—	300	—	MHz	
		$V_s = 300mV_{rms}$ sine wave $ V_c  = 5V_{dc}$	—	80	—	MHz	
Voltage Gain, Signal Channel	$AV_S$	$V_s = 100mV_{rms}$ $f_s = 1.0kHz$ $ V_c  = 0.5V_{dc}$	2.5	3.5	—	V/V	
Signal Port Common Mode Input Voltage Range	$CM_V$	$f_s = 1.0kHz$	—	5.0	—	V <sub>p-p</sub>	
Signal Port Common Mode Rejection Ratio	ACM	$f_s = 1.0kHz$ , $ V_c  = 0.5V_{dc}$	—	-85	—	dB	
Differential Output Swing Capability	$DV_{out}$		—	8.0	—	V <sub>p-p</sub>	



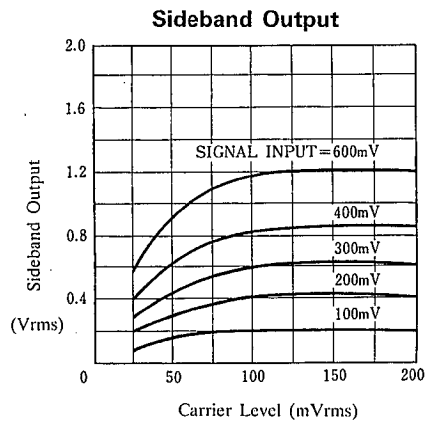
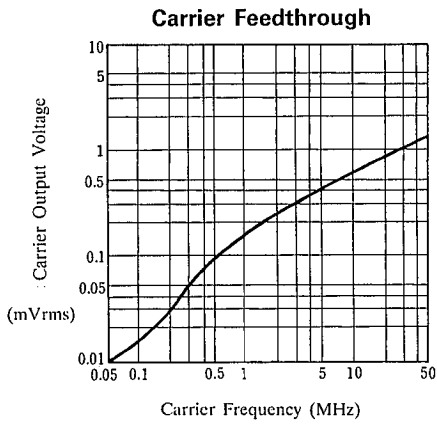
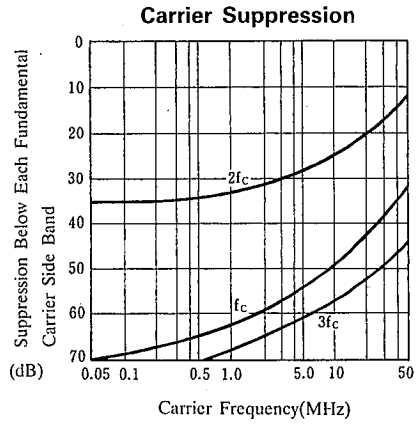
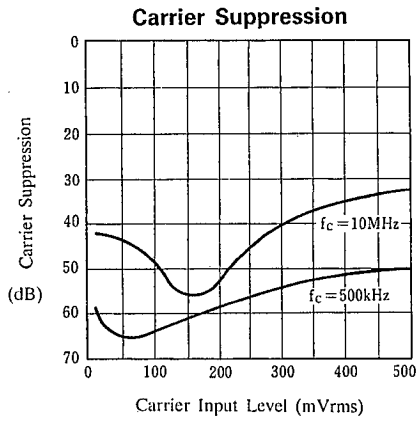
■ **TEST CIRCUIT**



Connect a  $100\mu F$  capacitor and a  $3000pF$  capacitor in parallel to each other, if the capacitance is not specified.

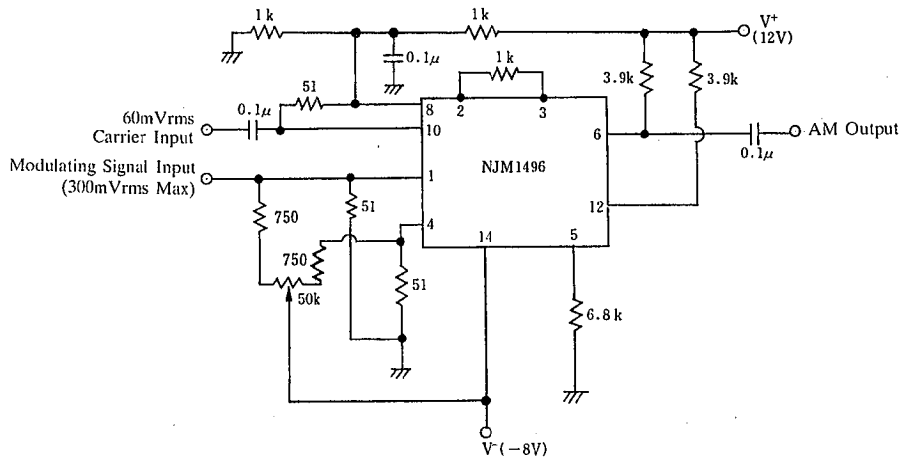
# NJM1496

## ■ TYPICAL CHARACTERISTICS

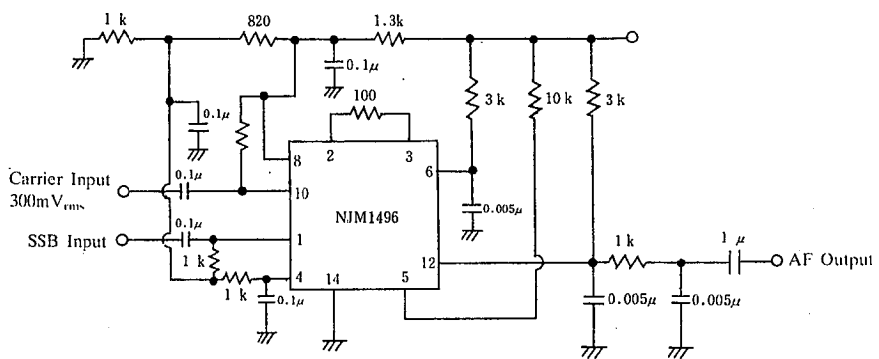


## ■ TYPICAL APPLICATIONS

### AM Modulator Circuit



### Product Detector (+12V DC Single Supply)



# NJM1496

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## MEMO

**[CAUTION]**

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