

DOUBLE BALANCED MODULATION / DEMODULATOR

■ 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.

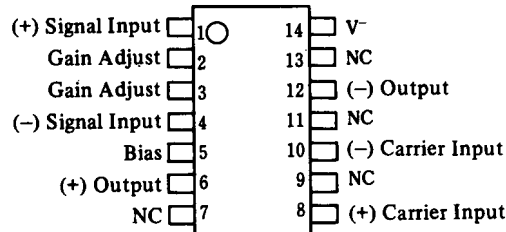
■ FEATURES

- Excellent carrier suppression
65dB typical at 0.5MHz
50dB 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

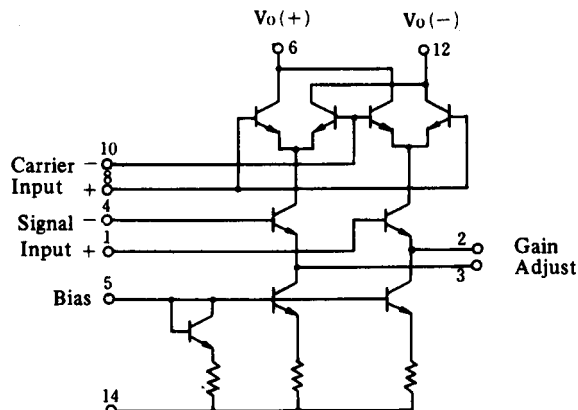
- Balanced Modulation
- Synchronous Detection
- FM Detection
- Phase Detection
- Sampling

■ PIN CONFIGURATION

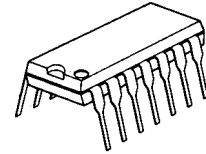


NJM1496D
NJM1496M
NJM1496V

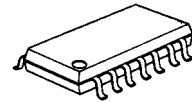
■ EQUIVALENT CIRCUIT



■ PACKAGE OUTLINE



NJM1496D



NJM1496M



NJM1496V

NJM1496

■ ABSOLUTE MAXIMUM RATINGS

(T_a=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 _s , R _e) (Applied Pins 1-4)	V
Input Signal	5	V
Bias Current (I _s)	10	mA
Power Dissipation	(DIP14) 570	mW
	(DMP14) 300	mW
	(SSOP14) 300	mW
Operating Temperature Range	-20 to +75	°C
Storage Temperature Range	-40 to +125	°C

■ ELECTRICAL CHARACTERISTICS

DC characteristics (V⁺=12V, V⁻=-8V, I_s=1.0mA, R_L=3.9kΩ, R_e=1.0kΩ, T_a=25°C)

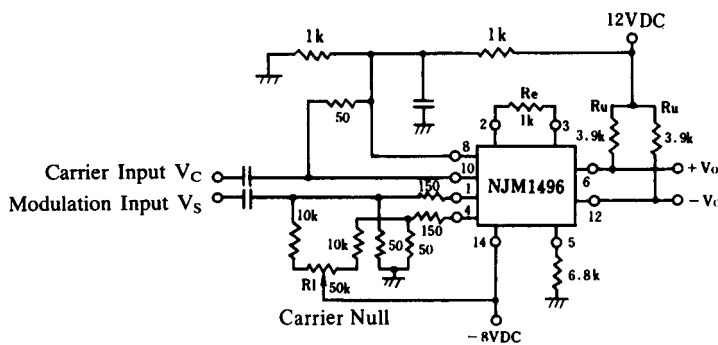
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Single-Ended Input Impedance						
Parallel Input Resistance	R _{ip}	Signal Port, f =5.0MHz	-	200	-	kΩ
Parallel Input Capacitance	C _{ip}	Signal Port, f =5.0MHz	-	2.0	-	pF
Single-Ended Output Impedance						
Parallel Output Resistance	R _{op}	f =10MHz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

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

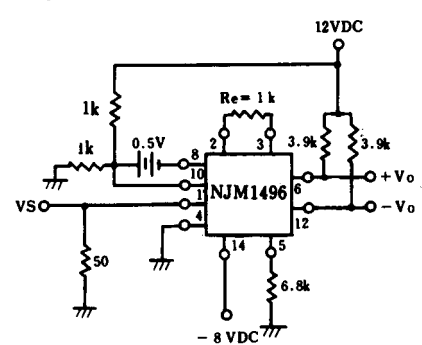
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Carrier Feedthrough	V_{CFT}	$V_C=60mV_{rms}$ sine wave offset adjusted	-	40	-	μV_{rms}	
		$f_C=1.0kHz$	-	140	-	μV_{rms}	
	V_{CFT}	$V_C=300mV_{P-P}$ square wave $f_C=1.0kHz$ offset adjusted	-	0.04	0.4	mV_{rms}	
		offset not adjusted	-	20	200	mV_{rms}	
	Carrier Suppression	V_{CS}	$f_S=10kHz$, $300mV_{rms}$ sine wave offset adjusted	40	65	-	dB
		V_{CS}	$f_C=500kHz$, $60mV_{rms}$ sine wave $f_C=10MHz$, $60mV_{rms}$ sine wave	-	50	-	dB
Transadmittance Bandwidth ($R_L=50\Omega$)	BW 3dB	$V_C=60mV_{rms}$ sine wave $f_S=1.0kHz$, $300mV_{rms}$ sine wave	-	300	-	MHz	
Carrier Input Port	BW 3dB	$V_S=300mV_{rms}$ sine wave $ V_C =0.5V_{dc}$	-	80	-	MHz	
Signal Input Port	BW 3dB	$V_S=100mV_{rms}$, $f_S=1.0kHz$ $ V_C =0.5V_{dc}$	2.5	3.5	-	V/V	
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_{P-P}	
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_{P-P}	

■ **TEST CIRCUIT**

- Carrier feedthrough
- Carrier Suppression



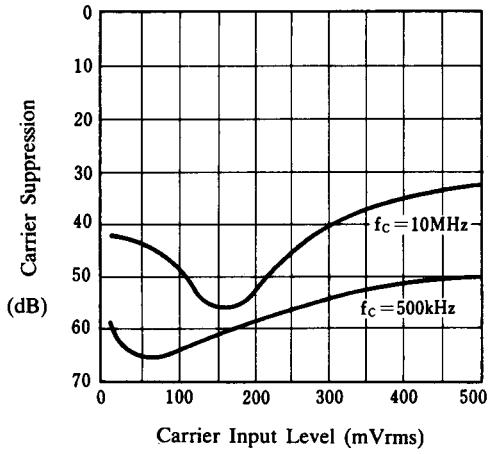
- Differential Output Swing Capability
- Signal Port Common Mode Rejection Ratio



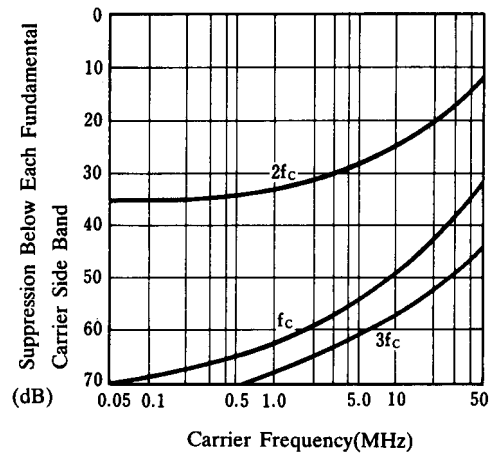
Connect a $100\mu F$ capacitor and a $3000pF$ capacitor in parallel to each other, if the capacitance is not specified.

■ TYPICAL CHARACTERISTICS

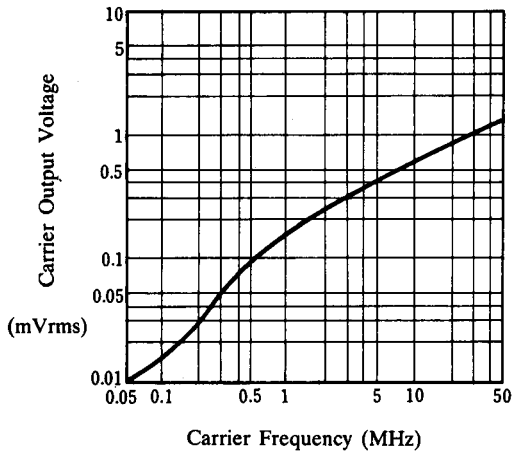
Carrier Suppression



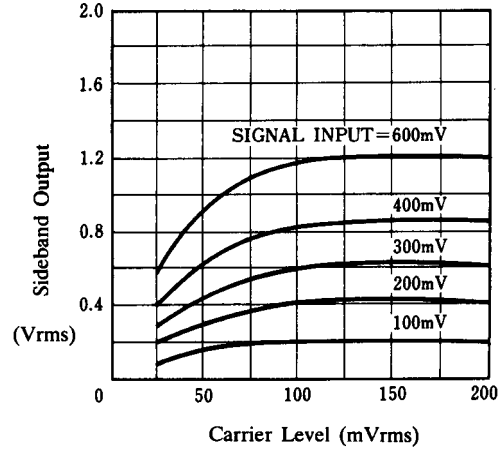
Carrier Suppression



Carrier Feedthrough

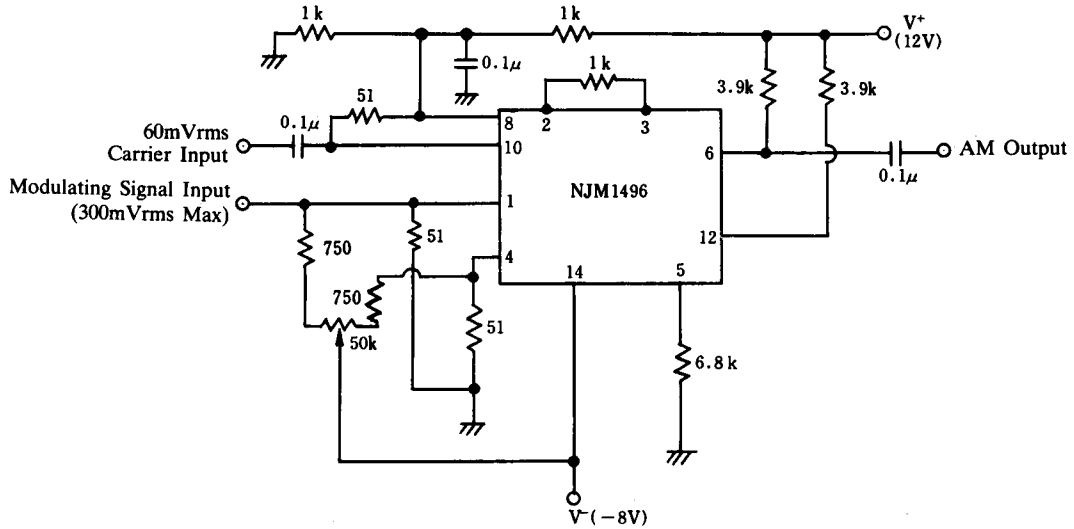


Sideband Output

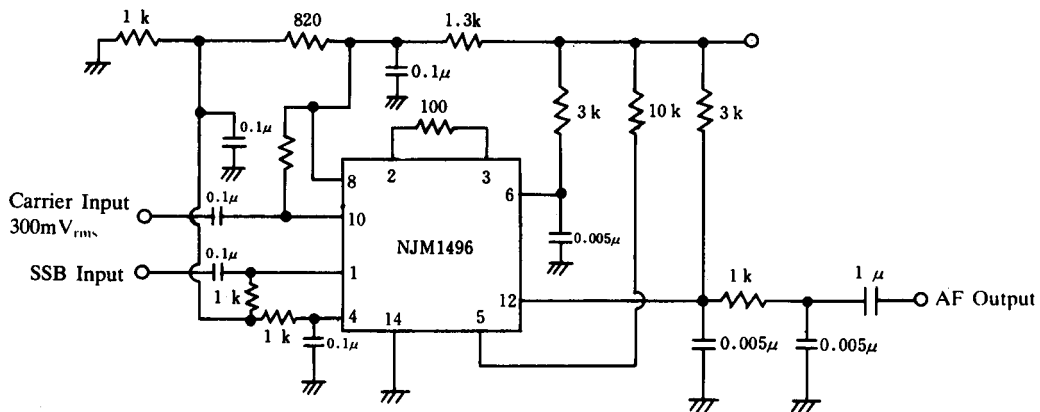


■ TYPICAL APPLICATIONS

AM Modulator Circuit



Product Detector (+12V DC Single Supply)



[CAUTION]

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