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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.

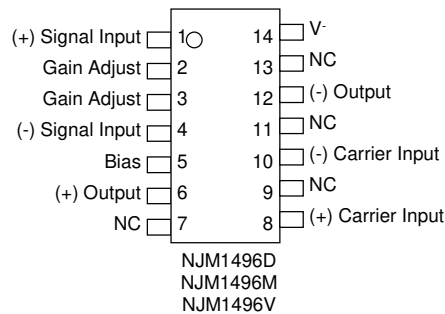
■ FEATURES

- 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

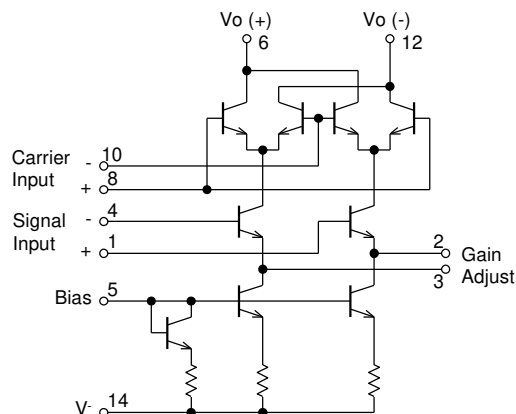
■ APPLICATION

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

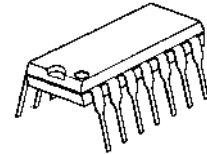
■ PIN CONFIGURATION



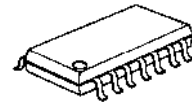
■ EQUIVALENT CIRCUIT



■ PACKAGE OUTLINE



NJM1496D



NJM1496M



NJM1496V

NJM1496

■ ABSOLUTE MAXIMUM RATINGS

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

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	$\pm(5+I_5 \cdot R_e)$ (Applied Pins 1-4)	V
Input Signal	5	V
Bias Current (I_5)	10	mA
Power Dissipation	(DIP14) 570	mW
	(DMP14) 300	mW
	(SSOP14) 300	mW
Operating Temperature Range	-40 to +85	$^\circ\text{C}$
Storage Temperature Range	-40 to +125	$^\circ\text{C}$

■ ELECTRICAL CHARACTERISTICS

DC characteristics ($V^+=12\text{V}$, $V^-=-8\text{V}$, $I_5=1.0\text{mA}$, $R_L=3.9\text{k}\Omega$, $R_e=1.0\text{k}\Omega$, $T_a=25^\circ\text{C}$)

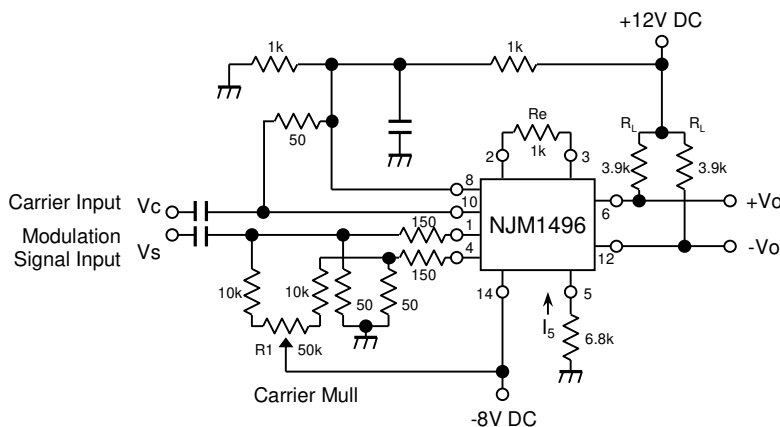
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Single-Ended Input Impedance						
Parallel Input Resistance	R_{ip}	Signal Port, $f=5.0\text{MHz}$	-	200	-	$\text{k}\Omega$
Parallel Input Capacitance	C_{ip}	Signal Port, $f=5.0\text{MHz}$	-	2.0	-	pF
Single-Ended Output Impedance						
Parallel Output Resistance	R_{op}	$f=10\text{MHz}$	-	40	-	$\text{k}\Omega$
Parallel Output Capacitance	C_{op}	$f=10\text{MHz}$	-	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	-	$\text{nA}/^\circ\text{C}$
Output Offset Current						
$(I_6 - I_{12})$	I_{oc}		-	15	80	μA
Average Temperature Coefficient of Output Offset Current	ΔI_{oc}		-	90	-	$\text{nA}/^\circ\text{C}$
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 ($V^+=12V$, $V^-=-8V$, $I_5=1.0mA$, $R_L=3.9k\Omega$, $R_e=1.0k\Omega$, $T_a=25^\circ C$)

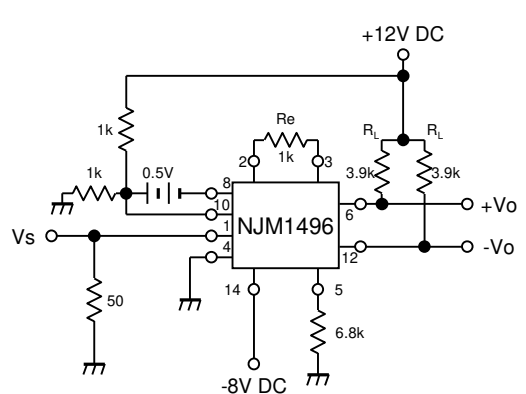
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Carrier Feedthrough	V_{CFT}	$V_C=60mV_{rms}$ sine wave offset adjusted	-	40	-	μV_{rms}
		$f_C=1.0kHz$	-	140	-	μV_{rms}
	V_{CFT}	$V_C=300mV_{P-P}$ square wave $f_C=1.0kHz$ offset adjusted	-	0.04	0.4	mV_{rms}
		offset not adjusted	-	20	200	mV_{rms}
	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

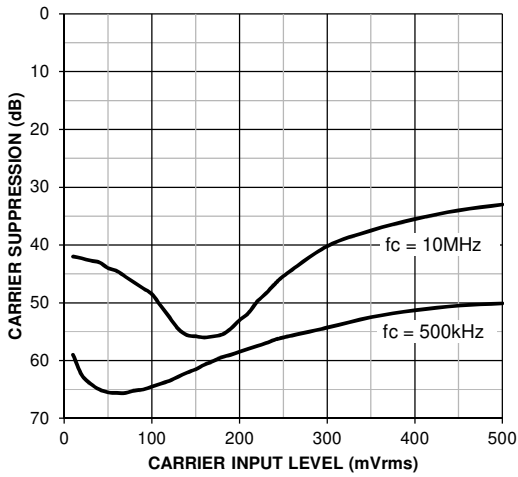


Connect a 100uF capacitor and a 3000pF capacitor in parallel to each other, if the capacitance is not specified.

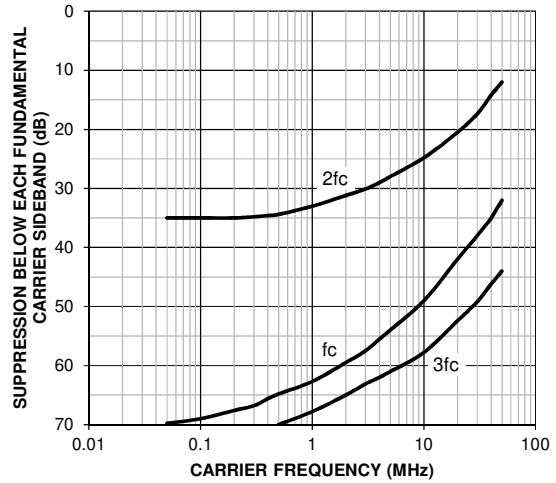
NJM1496

■ TYPICAL CHARACTERISTICS

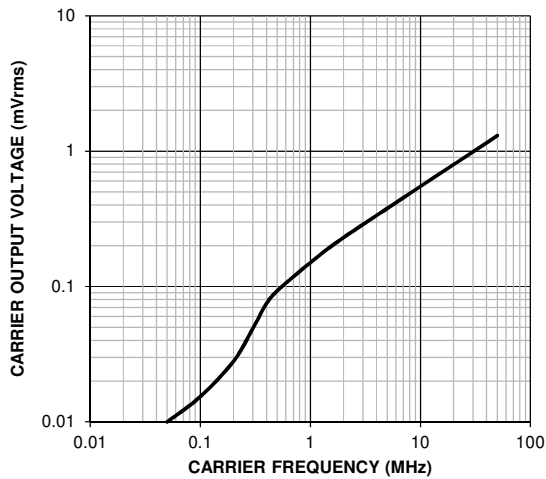
Carrier Suppression versus Carrier Input Level



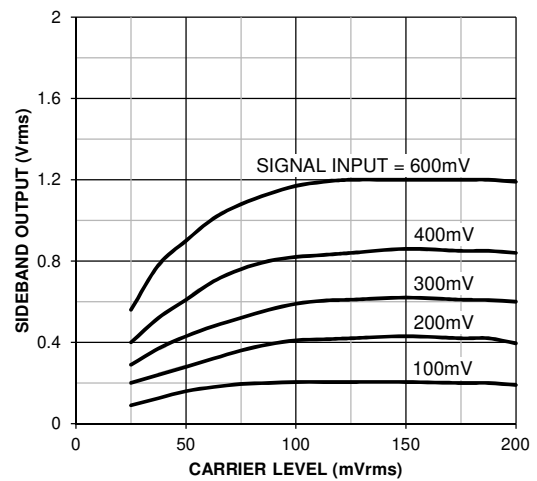
Carrier Feedthrough versus Frequency



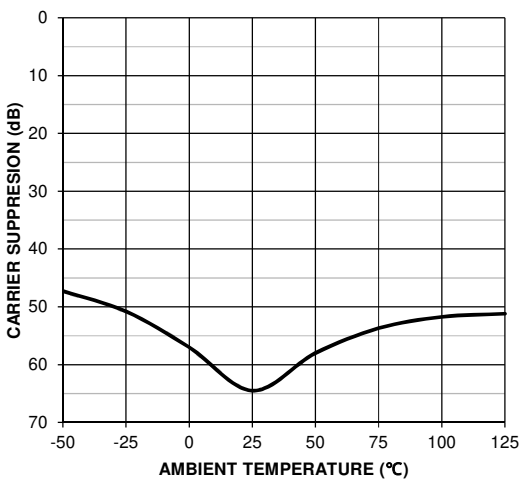
Carrier Feedthrough versus Frequency



Sideband Output versus Carrier Levels

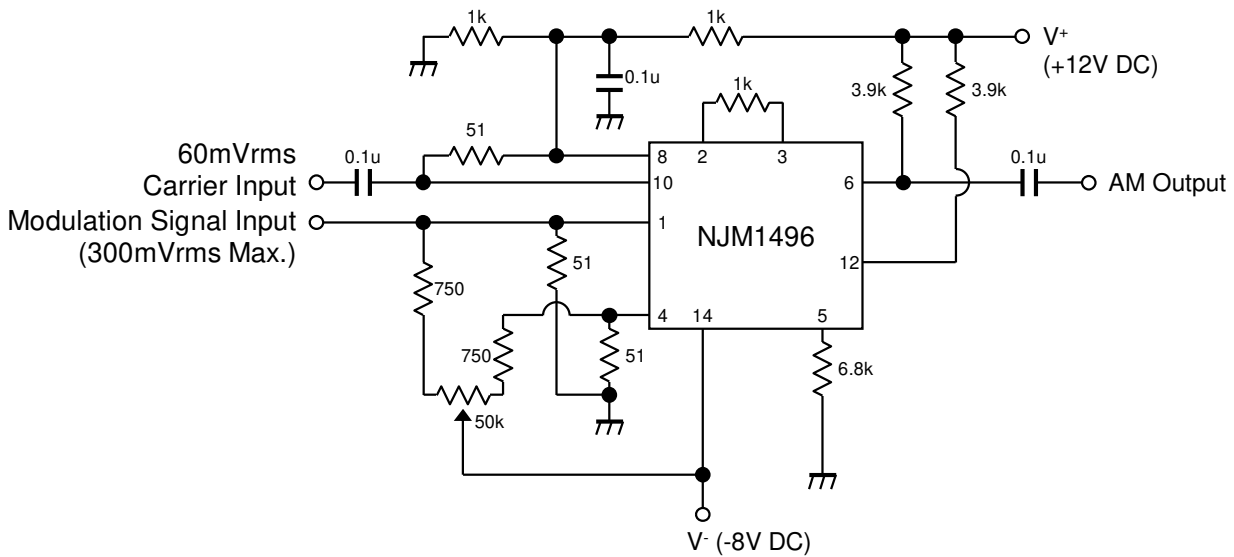


Carrier Suppression versus Temperature

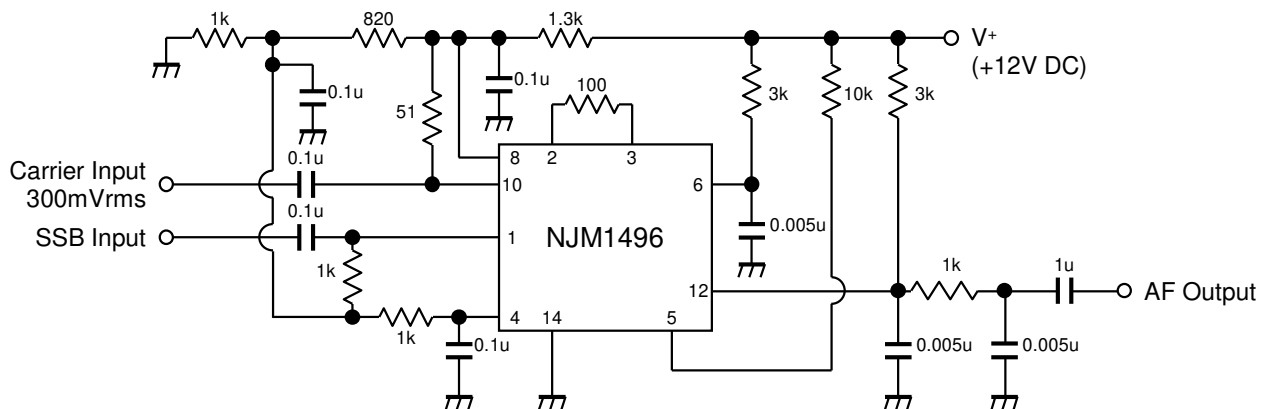


■ TYPICAL APPLICATIONS

AM Modulator Circuit



Product Detector (+12V DC Single Supply)



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