

BALANCED MODULATOR/DEMODULATOR

MC1496/MC1596

DESCRIPTION

The MC1496 is a monolithic Double-Balanced Modulator/Demodulator designed for use where the output voltage is a product of an input voltage (signal) and a switched function (carrier). The MC1596 will operate over the full military temperature range of -55°C to $+125^{\circ}\text{C}$. The MC 1496 is intended for applications within the range of 0°C to $+70^{\circ}\text{C}$.

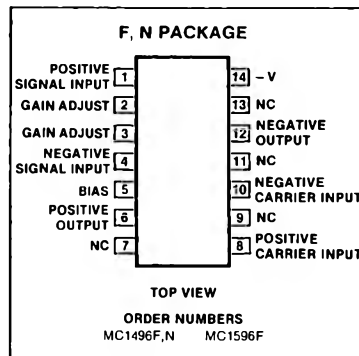
FEATURES

- Excellent carrier suppression
65dB typ @ 0.5MHz
50dB typ @ 10MHz
- Adjustable gain and signal handling
- Balanced inputs and outputs
- High common-mode rejection—85dB typ

APPLICATIONS

- Suppressed carrier and amplitude modulation
- Synchronous detection
- FM detection
- Phase detection
- Sampling
- Single sideband
- Frequency doubling

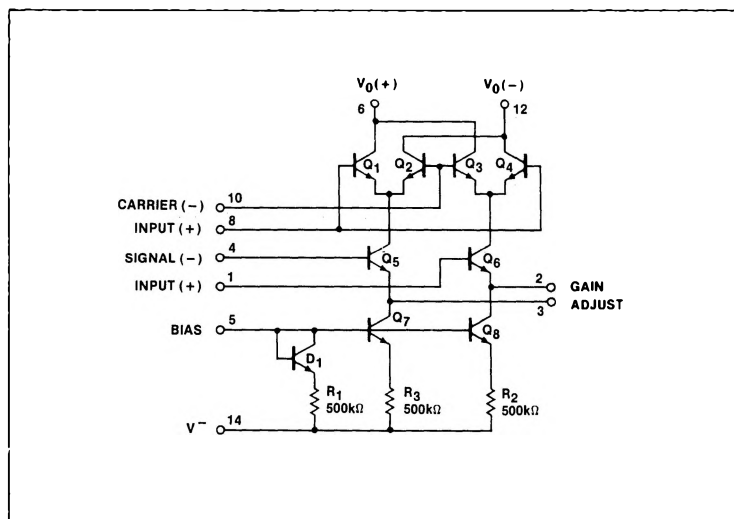
PIN CONFIGURATIONS



ABSOLUTE MAXIMUM RATINGS

PARAMETER	RATING	UNIT
Applied voltage	30	V
Differential input signal (V_8 - V_{10})	± 5.0	V
Differential input signal (V_4 - V_1)	$(5 \pm I_5 R_E)$	V
Input signal (V_2 - V_1 , V_3 - V_4)	5.0	V
Bias current (I_5)	10	mA
Power dissipation (pkg. limitation) N package	900	mW
Operating temperature range MC1496	0 to $+70$	$^{\circ}\text{C}$
MC1596	-55 to $+125$	$^{\circ}\text{C}$
Storage temperature range	-65 to $+150$	$^{\circ}\text{C}$

EQUIVALENT SCHEMATIC

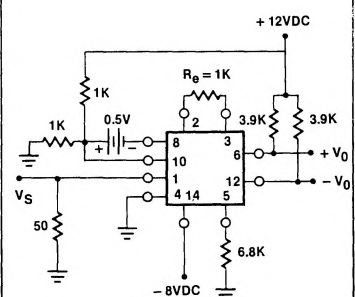
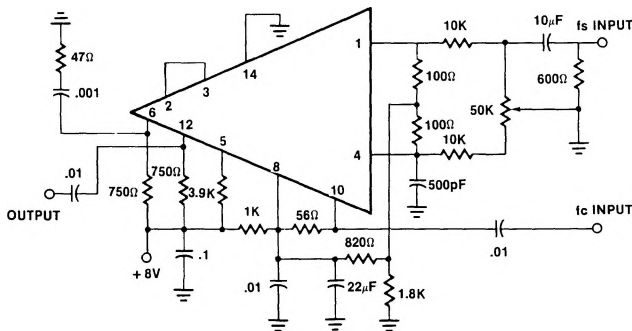


$V^+ = +12\text{Vdc}$, $V^- = -8.0\text{Vdc}$, $I_S = 1.0\text{mA dc}$, $R_L = 3.9\text{k}\Omega$, $R_\theta = 1.0\text{k}\Omega$, $T_A = 25^\circ\text{C}$ unless otherwise specified.

PARAMETER	TEST CONDITIONS	MC1596			MC1496			UNIT
		Min	Typ	Max	Min	Typ	Max	
R _{ip} C _{ip}	Single-ended input impedance Parallel input resistance Parallel input capacitance		200 2.0			200 2.0		kΩ pF
R _{op} C _{op}	Single-ended output impedance Parallel output resistance Parallel output capacitance		40 5.0			40 5.0		kΩ pF
I _{bs} I _{bc}	Input bias current $I_{bs} = \frac{I_1 + I_4}{2}$ $I_{bc} = \frac{I_8 + I_{10}}{2}$		12 12	25 25		12 12	30 30	μA μA
I _{ios} I _{ioC}	Input offset current $I_{ios} = I_1 - I_4$ $I_{ioC} = I_8 - I_{10}$		0.7 0.7	5.0 5.0		0.7 0.7	7.0 7.0	μA μA
T _{clio} I _{loo}	Average temperature coefficient of input offset current Output offset current $I_6 - I_{12}$		2.0 14			2.0 15		nA/°C μA
T _{cloo} V _o	Average temperature coefficient of output offset current Common-mode quiescent Output voltage (Pin 6 or Pin 12)		90 8.0			90 8.0		nA/°C Vdc
I _{D+} I _{D-}	Power supply current $I_6 + I_{12}$ I ₁₄		2.0 3.0	3.0 4.0		2.0 3.0	4.0 5.0	mAdc
P _D	DC power dissipation		33			33		mW

TEST CIRCUIT

SIGNAL GAIN AND OUTPUT SWING



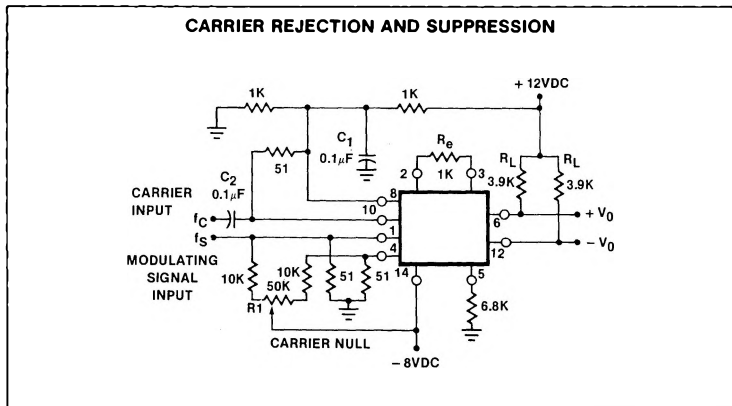
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AC ELECTRICAL CHARACTERISTICS $V^+ = +12V_{dc}$, $V^- = -9.0V_{dc}$, $I_S = 1.0mA_{dc}$, $R_L = 3.9k\Omega$, $R_\theta = 1.0k\Omega$,
 $T_A = +25^\circ C$ unless otherwise specified.

PARAMETER		TEST CONDITIONS	MC1596			MC1496			UNIT
			Min	Typ	Max	Min	Typ	Max	
V _{CFT}	Carrier feedthrough	V _C = 60mVrms sinewave and offset adjusted to zero f _C = 1.0kHz f _C = 10MHz		40 140			40 140		μVrms
		V _C = 300mVp-p squarewave: Offset adjusted to zero f _C = 1.0kHz Offset not adjusted f _C = 1.0kHz		0.04 20	0.2 100		0.04 20	0.4 200	mVrms
V _{CS}	Carrier suppressions	f _S = 10kHz, 300mVrms sinewave f _C = 500kHz, 60mVrms sinewave f _C = 10MHz, 60mVrms sinewave	50	65 50		40	65 50		dB
BW _{3dB}	Transadmittance bandwidth (Magnitude) (R _L = 50Ω)	Carrier input port, V _C = 60mVrms sinewave f _S = 1.0kHz, 300mVrms sinewave		300			300		MHz
		Signal input port, V _S = 300mVrms sinewave V _C = 0.5Vdc		80			80		MHz
AV _S	Signal gain	V _S = 100mVrms; f = 1.0kHz V _C = 0.5Vdc	2.5	3.5		2.5	3.5		V/V
CMV ACM	Common-mode input swing Common-mode gain	Signal port, f _S = 1.0kHz Signal port, f _S = 1.0kHz V _C = 0.5Vdc		5.0 -85			5.0 -85		Vp-p dB
DV _{OUT}	Differential output voltage swing capability			8.0			8.0		Vp-p

TEST CIRCUIT



*For additional information, consult the Applications Section.