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°C. The MC 1496 is intended for applications within the range of 0°C to +70°C.

APPLICATIONS

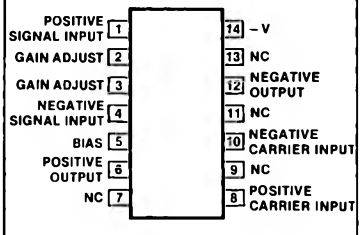
- **Suppressed carrier and amplitude modulation**
- **Synchronous detection**
- **FM detection**
- **Phase detection**
- **Sampling**
- **Single sideband**
- **Frequency doubling**

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**

PIN CONFIGURATIONS

F, N PACKAGE



TOP VIEW

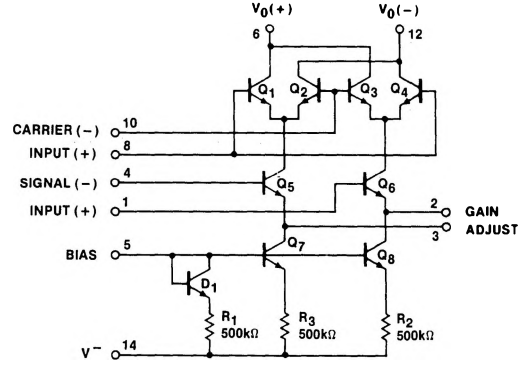
ORDER NUMBERS

MC1496F,N MC1596F

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 ± 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	°C
MC1596	-55 to +125	°C
Storage temperature range	-65 to +150	°C

EQUIVALENT SCHEMATIC



BALANCED MODULATOR/DEMODULATOR MC1496/MC1596

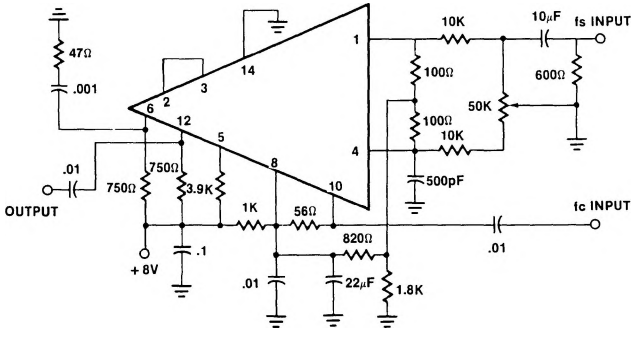
DC ELECTRICAL CHARACTERISTICS

$V^+ = +12Vdc$, $V^- = -8.0Vdc$, $I_5 = 1.0mAdc$, $R_L = 3.9k\Omega$, $R_e = 1.0k\Omega$, $T_A = 25°C$ unless otherwise specified.

PARAMETER		TEST CONDITIONS	MC1596			MC1496			UNIT
			Min	Typ	Max	Min	Typ	Max	
	Single-ended input impedance	Signal port, f = 5.0MHz							
R_{ip}	Parallel input resistance			200			200		kΩ
C_{ip}	Parallel input capacitance			2.0			2.0		pF
	Single-ended output impedance	f = 10MHz							
R_{op}	Parallel output resistance			40			40		kΩ
C_{op}	Parallel output capacitance			5.0			5.0		pF
	Input bias current								μA
I_{bS}	$I_{bS} = \frac{I_1 + I_4}{2}$			12	25		12	30	
I_{bC}	$I_{bS} = \frac{I_8 + I_{10}}{2}$			12	25		12	30	μA
	Input offset current								μA
I_{ioS}	$I_{ioS} = I_1 - I_4$			0.7	5.0		0.7	7.0	
I_{ioC}	$I_{ioC} = I_8 - I_{10}$			0.7	5.0		0.7	7.0	μA
$T_C I_{io}$	Average temperature coefficient of input offset current			2.0			2.0		nA/°C
	Output offset current								
I_{oo}	$I_6 - I_{12}$			14	50		15	80	μA
$T_C I_{oo}$	Average temperature coefficient of output offset current			90			90		nA/°C
	Common-mode quiescent								
V_o	Output voltage (Pin 6 or Pin 12)			8.0			8.0		Vdc
	Power supply current								mAdc
I_{D+}	$I_6 + I_{12}$			2.0	3.0		2.0	4.0	
I_{D-}	I_{14}			3.0	4.0		3.0	5.0	
P_D	DC power dissipation			33			33		mW

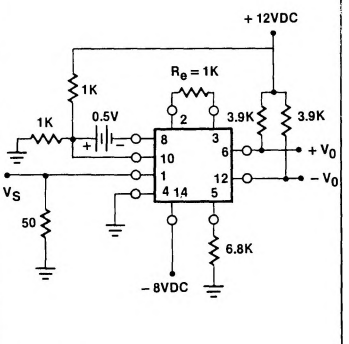
TEST CIRCUIT

CARRIER REJECTION AND SUPPRESSION



TEST CIRCUIT

SIGNAL GAIN AND OUTPUT SWING



BALANCED MODULATOR/DEMODULATOR MC1496/MC1596

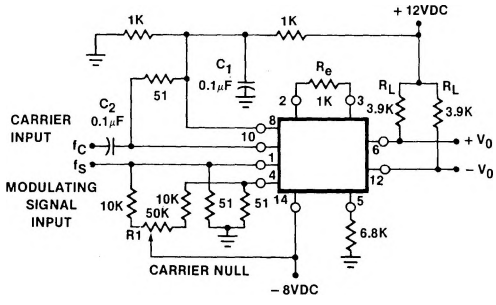
AC ELECTRICAL CHARACTERISTICS

$V^+ = +12Vdc$, $V^- = -9.0Vdc$, $I_5 = 1.0mAdc$, $R_L = 3.9k\Omega$, $R_e = 1.0k\Omega$, $T_A = +25°C$ 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		40			40		μVrms
		f_C = 10MHz		140			140		
		V_c = 300mVp-p squarewave:							
		Offset adjusted to zero f_C = 1.0kHz		0.04	0.2		0.04	0.4	mVrms
		Offset not adjusted f_C = 1.0kHz		20	100		20	200	
V_{CS}	Carrier suppressions	f_S = 10kHz, 300mVrms sinewave							
		f_C = 500kHz, 60mVrms sinewave	50	65		40	65		dB
		f_C = 10MHz, 60mVrms sinewave		50			50		
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	Common-mode input swing	Signal port, f_s = 1.0kHz		5.0			5.0		Vp-p
ACM	Common-mode gain	Signal port, f_S = 1.0kHz $\|V_C\|$ = 0.5Vdc		-85			-85		dB
DV_{OUT}	Differential output voltage swing capability			8.0			8.0		Vp-p

TEST CIRCUIT

CARRIER REJECTION AND SUPPRESSION



*For additional information, consult the Applications Section.