

NTE973D Integrated Circuit Double Balanced Modulator/Demodulator

Description:

The NTE973D is a balanced modulator/demodulator in a 14-Lead DIP type package designed for use where the output voltage is a product of an input voltage (signal) and a switching function (carrier). Typical applications include suppressed carrier and amplitude modulation, synchronous detection, FM detection, phase detection, and chopper applications.

Features:

- Excellent Carrier Suppression:
65dB typ @ 0.5MHz
50db typ @ 10MHz
- Adjustable Gain and Signal Handling
- Balanced Inputs and Outputs

Absolute Maximum Ratings: ($T_A = +25^\circ\text{C}$ unless otherwise specified)

Applied Voltage, ΔV (V_6-V_7 , V_8-V_1 , V_9-V_7 , V_9-V_8 , V_7-V_4 , V_7-V_1 , V_8-V_4 , V_6-V_8 , V_2-V_5 , V_3-V_5)	30V
Differential Input Signal, V_7-V_8	+5.0V
Differential Input Signal, V_4-V_1	$\pm(5 + I_5 R_e)$ V
Maximum Bias Current, I_5	10mA
Operating Temperature Range, T_A	0° to $+70^\circ\text{C}$
Storage Temperature Range, T_{stg}	-65° to $+150^\circ\text{C}$
Thermal Resistance, Junction-to-Ambient, R_{thJA}	100°C/W

Electrical Characteristics: ($V_{CC} = 12\text{V}$, $V_{EE} = -8\text{V}$, $I_5 = 1\text{mA}$, $R_L = 3.9\text{k}\Omega$, $R_e = 1\text{k}\Omega$, $T_A = +25^\circ\text{C}$, Note 1 unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Carrier Feedthrough	V_{CFT}	$V_C = 60\text{mV}_{\text{rms}}$ sine wave and offset adjusted to zero	$f_C = 1\text{kHz}$	—	40	μV_{rms}
			$f_C = 10\text{MHz}$	—	140	μV_{rms}
		$V_C = 300\text{mV}_{\text{P-P}}$ square wave, $f_C = 1\text{kHz}$	Offset adjusted to zero	—	0.04	mV_{rms}
			Offset not adjusted	—	20	mV_{rms}
Carrier Suppression	V_{CS}	$f_S = 10\text{kHz}$, $300\text{mV}_{\text{rms}}$, 60mV_{rms} sine wave	$f_C = 500\text{kHz}$	40	65	dB
			$f_C = 10\text{MHz}$	—	50k	dB

Note 1. All input and output characteristics are single-ended unless otherwise specified)

Electrical Characteristics (Cont'd): ($V_{CC} = 12V$, $V_{EE} = -8V$, $I_5 = 1mA$, $R_L = 3.9k\Omega$, $R_e = 1k\Omega$, $T_A = +25^\circ C$, Note 1 unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Transadmittance Bandwidth (Magnitude)	BW_{3dB}	Carrier Input Port, $R_L = 50\Omega$, $V_C = 60mV_{rms}$ sine wave, $f_S = 1kHz$, $300mV_{rms}$ sine wave	–	300	–	MHz
		Signal Input Port, $R_L = 50\Omega$, $V_S = 300mV_{rms}$ sine wave, $ V_C = 0.5V$	–	80	–	MHz
Signal Gain	A_{VS}	$V_S = 100mV_{rms}$, $f = 1kHz$, $ V_C = 0.5V$	2.5	3.5	–	V/V
Single-Ended Input Impedance, Signal Port	r_{ip}	Parallel Input Resistance, $f = 5MHz$	–	200	–	$k\Omega$
	C_{ip}	Parallel Input Capacitance, $f = 5MHz$	–	2.0	–	pF
Single-Ended Output Impedance, Signal Port	r_{op}	Parallel Output Resistance, $f = 10MHz$	–	40	–	$k\Omega$
	C_{op}	Parallel Output Capacitance, $f = 10MHz$	–	5.0	–	pF
Input Bias Current	I_{bS}	$I_{bS} = (I_1 + I_4) / 2$	–	12	30	μA
	I_{bC}	$I_{bC} = (I_7 + I_8) / 2$	–	12	30	μA
Input Offset Current	$ I_{ioS} $	$I_{ioS} = I_1 - I_4$	–	0.7	7.0	μA
	$ I_{ioC} $	$I_{ioC} = I_7 - I_8$	–	0.7	7.0	μA
Average Temperature Coefficient of Input Offset Current	$ TC_{Iio} $	$T_A = -55^\circ$ to $+125^\circ C$	–	2.0	–	$nA/^\circ C$
Output Offset Current	$ I_{oo} $	$I_6 - I_9$	–	14	80	μA
Average Temperature Coefficient of Output Offset Current	$ TC_{Ioo} $	$T_A = -55^\circ$ to $+125^\circ C$	–	90	–	$nA/^\circ C$
Common-Mode Input Swing	CMV	Signal Port, $f_S = 1kHz$	–	5.0	–	V_{P-P}
Common-Mode Gain	ACM	Signal Port, $f_S = 1kHz$, $ V_C = 0.5V$	–	–85	–	dB
Common-Mode Quiescent Output Voltage	V_{out}	Pin6 or Pin9	–	8.0	–	V_{P-P}
Differential Output Voltage Swing Capability	V_{out}		–	8.0	–	V_{P-P}
Power Supply Current	I_{CC}	$I_6 + I_9$	–	2.0	4.0	mA
	I_{EE}	I_{10}	–	3.0	5.0	mA
DC Power Dissipation	P_D		–	33	–	mW

Note 1. All input and output characteristics are single-ended unless otherwise specified)

Pin Connection Diagram





