

NTE980 Integrated Circuit CMOS, Micropower Phase-Locked Loop (PLL)

Description:

The NTE980 CMOS Micropower Phase-Locked Loop (PLL) consists of a low-power, linear voltage-controlled oscillator (VCO) and two different phase comparators having a common signal-input amplifier and a common comparator input in a 16-Lead type package. A 5.2V zener diode is provided for supply regulation if necessary.

Features:

- Very Low Power Consumption: 70 μ W (Typ) @ VCO f_o = 10kHz, V_{DD} = 5V
- Operating Frequency Range up to 1.4MHz (Typ) @ V_{DD} = 10V, R_I = 5k Ω
- Low Frequency Drift: 0.04%/°C (Typ) @ V_{DD} = 10V
- Choice of Two Phase Comparators:
 - Exclusive-OR Network (I)
 - Edge-Controlled Memory Network ^w/Phase-Pulse Output for Lock Indication (II)
- High VCO Linearity: < 1% (Typ) @ V_{DD} = 10V
- VCO Inhibit Control for ON-OFF Keying and Ultra-Low Standby Power Consumption
- Source-Follower Output of VCO Control Input (Demod. Output)
- Zener Diode to Assist Supply Regulation
- Standardized, Symmetrical Output Characteristics
- 100% Tested for Quiescent Current at 20V
- 5V, 10V, and 15V Parametric Ratings

Applications:

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| <ul style="list-style-type: none"> ● FM Demodulator and Modulator ● Frequency Synthesis and Multiplication ● Frequency Discriminator ● Signal Conditioning | <ul style="list-style-type: none"> ● FSK – Modems ● Data Synchronization ● Voltage-to-Frequency Conversion ● Tone Decoding |
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Absolute Maximum Ratings:

DC Supply Voltage Range (Voltages referenced to V_{SS} terminal), V_{DD}	–0.5 to +20V
Input Voltage Range, All Inputs	–0.5 to $V_{DD}+0.5V$
DC Input Current, Any One Input	$\pm 10mA$
Power Dissipation (T_A = –40° to +60°C), P_D	500mW
T_A = +60° to +85°C	Derate Linearly at 12mW/°C to 200mW
Device Dissipation Per Output Transistor (T_A = –40° to +85°C)	100mW
Operating Temperature Range, T_A	–40° to +85°C
Storage Temperature Range, T_{stg}	–65° to +150°C
Lead Temperature (During Soldering, 1/16" $\pm$ 1/32" from case, 10sec Max), T_L	+265°C

Recommended Operating Conditions: ($T_A = -40^\circ$ to $+85^\circ\text{C}$)

Parameter	Min	Typ	Max	Unit
Supply Voltage Range VCO Section: As Fixed Oscillator	3	–	18	V
Phase–Lock–Loop Operation	5	–	18	V
Supply Voltage Range Phase Comparator Section: Comparators	3	–	18	V
VCO Operation	5	–	18	V

Static Electrical Characteristics: ($T_A = +25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Test Conditions			Min	Typ	Max	Unit
		V _O	V _{IN}	V _{DD}				
VCO Section								
Output Low (Sink) Current	I _{OL} Min	400mV	0V, 5V	5V	0.51	1.0	–	mA
		500mV	0V, 10V	10V	1.3	2.6	–	mA
		1.5V	0V, 15V	15V	3.4	6.8	–	mA
Output High (Source) Current	I _{OH} Min	4.6V	0V, 5V	5V	–0.51	–1.0	–	mA
		2.5V	0V, 5V	5V	–1.6	–3.2	–	mA
		9.5V	0V, 10V	10V	–1.3	–2.6	–	mA
		13.5V	0V, 15V	15V	–3.4	–6.8	–	mA
Output Voltage: Low–Level	V _{OL} Max	Pin4 driving CMOS	0V, 5V	5V	–	0	0.05	V
			0V, 10V	10V	–	0	0.05	V
			0V, 15V	15V	–	0	0.05	V
Output Voltage: High–Level	V _{OH} Max	e.g. Pin3	0V, 5V	5V	4.95	5.0	–	V
			0V, 10V	10V	9.95	10.0	–	V
			0V, 15V	15V	14.95	15.0	–	V
Input Current	I _{IN} Max	–	0V, 18V	18V	–	±10 ^{–5}	±0.1	µA
Phase Comparator Section								
Total Device Current Pin14 = Open, Pin5 = V _{DD} Pin14 = V _{SS} or V _{DD} , Pin5 = V _{DD}	I _{DD} Max	–	0V, 5V	5V	–	0.1	0.2	mA
		–	0V, 10V	10V	–	0.5	1.0	mA
		–	0V, 15V	15V	–	0.75	1.5	mA
		–	0V, 20V	20V	–	2.0	4.0	mA
		–	0V, 5V	5V	–	10.0	20.0	µA
		–	0V, 10V	10V	–	20.0	40.0	µA
		–	0V, 15V	15V	–	40.0	80.0	µA
		–	0V, 20V	20V	–	80.0	160.0	µA
Output Low (Sink) Current	I _{OL} Min	400mV	0V, 5V	5V	0.51	1.0	–	mA
		500mV	0V, 10V	10V	1.3	2.6	–	mA
		1.5V	0V, 15V	15V	3.4	6.8	–	mA
Output High (Source) Current	I _{OH} Min	4.6V	0V, 5V	5V	–0.51	–1.0	–	mA
		2.5V	0V, 5V	5V	–1.6	–3.2	–	mA
		9.5V	0V, 10V	10V	–1.3	–2.6	–	mA
		13.5V	0V, 15V	15V	–3.4	–6.8	–	mA

Static Electrical Characteristics (Cont'd): ($T_A = +25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Test Conditions			Min	Typ	Max	Unit
		V _O	V _{IN}	V _{DD}				
Phase Comparator Section (Cont'd)								
DC Coupled Signal Input and Comparator Input Voltage Sensitivity Low Level	V _{IL} Max	0.5V, 4.5V	–	5V	–	–	1.5	V
		1V, 9V	–	10V	–	–	3.0	V
		1.5V, 13.5V	–	15V	–	–	4.0	V
High Level	V _{IH} Max	0.5V, 4.5V	–	5V	3.5	–	–	V
		1V, 9V	–	10V	7.0	–	–	V
		1.5V, 13.5V	–	15V	11.0	–	–	V
Input Current (Except Pin14)	I _{IN} Max	–	0V, 18V	18V	–	±10 ^{–5}	±0.1	μA
3–State Leakage Current	I _{OUT} Max	0V, 18V	0V, 18V	18V	–	±10 ^{–5}	±0.1	μA

Electrical Characteristics: ($T_A = +25^\circ\text{C}$)

Parameter	Symbol	Test Conditions			Min	Typ	Max	Unit	
		V _{DD}							
VCO Section									
Operating Power Dissipation	P _D	f ₀ = 10kHz, R ₂ = ∞	R ₁ = 1MΩ, VCO _{IN} = $\frac{V_{DD}}{2}$	5V	–	70	140	μW	
				10V	–	800	1600	μW	
				15V	–	3000	6000	μW	
Maximum Operating Frequency	f _{max}	C ₁ = 50pF, R ₂ = ∞, VCO _{IN} = V _{DD}	R ₁ = 10kΩ	5V	0.3	0.6	–	MHz	
				10V	0.6	1.2	–	MHz	
				15V	0.8	1.6	–	MHz	
			R ₁ = 5kΩ	5V	0.5	0.8	–	MHz	
				10V	1.0	1.4	–	MHz	
				15V	1.4	2.4	–	MHz	
Linearity		VCO _{IN} = 2.5V±0.3V	R ₁ = 10kΩ	5V	–	1.7	–	%	
		VCO _{IN} = 5.0V±1.0V	R ₁ = 100kΩ	10V	–	0.5	–	%	
		VCO _{IN} = 5.0V±2.5V	R ₁ = 400kΩ	10V	–	4.0	–	%	
		VCO _{IN} = 7.5V±0.3V	R ₁ = 100kΩ	15V	–	0.5	–	%	
		VCO _{IN} = 7.5V±5.0V	R ₁ = 1MΩ	15V	–	7.0	–	%	
Temperature–Frequency Stability: No Frequency Offset	f _{MIN} = 0				5V	–	±0.12	–	%/°C
					10V	–	±0.04	–	%/°C
					15V	–	±0.015	–	%/°C
Frequency Offset	f _{MIN} ≠ 0				5V	–	±0.09	–	%/°C
					10V	–	±0.07	–	%/°C
					15V	–	±0.03	–	%/°C
Output Duty Cycle					5, 10, 15V	–	50	–	%
Output Transition Times	t _{THL} , t _{TLH}				5V	–	100	200	ns
					10V	–	50	100	ns
					15V	–	40	80	ns

Electrical Characteristics (Cont'd): ($T_A = +25^{\circ}\text{C}$)

Parameter	Symbol	Test Conditions		V _{DD}	Min	Typ	Max	Unit
VCO Section (Cont'd)								
Source-Follower Output (Demodulated Output): Offset Voltage	VCO _{IN} -V _{DEM}	RS > 10kΩ		5V	–	1.8	2.5	V
				10V	–	1.8	2.5	V
				15V	–	1.8	2.5	V
Linearity		VCO _{IN} = 2.5V±0.3V	RS = 100kΩ	5V	–	0.3	–	%
		VCO _{IN} = 5.0V±2.5V	RS = 300kΩ	10V	–	0.7	–	%
		VCO _{IN} = 7.5V±5.0V	RS = 500kΩ	15V	–	0.9	–	%
Zener Diode Voltage	VZ	I _Z = 50μA		–	4.45	5.50	6.15	V
Zener Dynamic Resistance	RZ	I _Z = 1mA		–	–	40	–	Ω
Phase Comparator Section								
Pin14 (Signal In) Input Resistance	R ₁₄			5V	1.0	2.0	–	MΩ
				10V	0.2	0.4	–	MΩ
				15V	0.1	0.2	–	MΩ
AC Coupled Signal Input Voltage Sensitivity (Peak-to-Peak)		f _{IN} = 100kHz, Sine Wave, Note 1		5V	–	180	360	mV
				10V	–	330	660	mV
				15V	–	900	1800	mV
Propagation Delay Time (Pin14 to Pin13) High to Low Level	t _{PHL}			5V	–	225	450	ns
				10V	–	100	200	ns
				15V	–	65	130	ns
Low to High Level	t _{PLH}			5V	–	350	700	ns
				10V	–	150	300	ns
				15V	–	100	200	ns
3-State Propagation Delay Time (Pin14 to Pin13) High Level to Low Impedance	t _{PHZ}			5V	–	225	450	ns
				10V	–	100	200	ns
				15V	–	95	190	ns
Low Level to High Impedance	t _{PLZ}			5V	–	285	570	ns
				10V	–	130	260	ns
				15V	–	95	190	ns
Input Rise or Fall Times Comparator Input (Pin3)	t _r , t _f			5V	–	–	50.0	μs
				10V	–	–	1.0	μs
				15V	–	–	0.3	μs
Signal Input (Pin14)				5V	–	–	500.0	μs
				10V	–	–	20.0	μs
				15V	–	–	2.5	μs
Output Transition Times	t _{THL} , t _{TLH}			5V	–	100	200	ns
				10V	–	50	100	ns
				15V	–	40	80	ns

Note 1. For sine wave, the frequency must be greater than 10kHz for Phase Comparator II.

Pin Connection Diagram

