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## NTE7001 Integrated Circuit Horizontal Combination Circuit for Color TV & Computer Monitors

**Description:**

The NTE7001 is a monolithic integrated circuit in a 16-Lead DIP type package intended for use in color television receivers.

**Features:**

- Horizontal Oscillation Based on the Threshold Switching Principle
- Phase Comparison Between Sync Pulse and Oscillator Voltage ( $\phi_1$ )
- Internal Key Pulse for Phase Detector ( $\phi_1$ ) (Additional Noise Limiting)
- Phase Comparison Between Line Flyback Pulse and Oscillator Voltage ( $\phi_2$ )
- Larger Catching Range Obtained by Coincidence Detector ( $\phi_3$ ; Between Sync and Key Pulse)
- Switch for Changing the Filter Characteristic and the Gate Circuit (VCR Operation)
- Sync Separator
- Noise Separator
- Vertical Sync Separator and Output Stage
- Color Burst Keying and Line Flyback Blanking Pulse Generator
- Phase Shifter for the Output Pulse
- Output Pulse Duration Switching
- Output Stage with Separate Supply Voltage for Direct Drive of Thyristor Deflection Circuits
- Low Supply Voltage Protection

**Applications:**

- Video Monitors
- TV Receivers

**Absolute Maximum Ratings:**

Supply Voltage

at Pin1 (Voltage Source), $V_{1-16}$ .....	13.2V
at Pin2, $V_{2-16}$ .....	18V

Voltages

Pin4, $V_{4-16}$ .....	13.2V
Pin9, $\pm V_{9-16}$ .....	6V
Pin10, $\pm V_{10-16}$ .....	6V
Pin11, $V_{11-16}$ .....	13.2V

**Absolute Maximum Ratings (Cont'd):**

Currents

Pin2 and Pin3 (Thyristor Driving, Peak Value), $I_{2M}, -I_{3M}$ .....	650mA
Pin2 and Pin3 (Transistor Driving, Peak Value), $I_{2M}, -I_{3M}$ .....	400mA
Pin4, $I_4$ .....	1mA
Pin6, $\pm I_6$ .....	10mA
Pin7, $-I_7$ .....	10mA
Pin11, $I_{11}$ .....	2mA

Total Power Dissipation,  $P_{TOT}$  ..... 800mW

Operating Ambient Temperature Range,  $T_A$  .....  $-20^\circ$  to  $+70^\circ\text{C}$

Storage Temperature Range,  $T_{stg}$  .....  $-25^\circ\text{C}$  to  $+125^\circ\text{C}$

**DC and AC Electrical Characteristics:** ( $V_{CC} = 12\text{V}$ ,  $T_A = +25^\circ\text{C}$  unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>Sync Separator</b>						
Input Switch Voltage	$V_{9-16}$		–	0.8	–	V
Input Keying Current	$I_9$		5	–	100	$\mu\text{A}$
Input Leakage Current	$I_9$	$V_{9-16} = -5\text{V}$	–	–	1	$\mu\text{A}$
Input Switching Current	$I_9$		–	–	5	$\mu\text{A}$
Switch OFF Current	$I_9$		100	150	–	$\mu\text{A}$
Input Signal (Peak-to-Peak Value)	$V_{9-16(P-P)}$	Note 1	3	–	4	V
<b>Noise Separator</b>						
Input Switching Voltage	$V_{10-16}$		–	1.4	–	V
Input Keying Current	$I_{10}$		5	–	100	$\mu\text{A}$
Input Switching Current	$I_{10}$		100	150	–	$\mu\text{A}$
Input Leakage Current	$I_{10}$	$V_{10-16} = -5\text{V}$	–	–	1	$\mu\text{A}$
Input Signal (Peak-to-Peak Value)	$V_{10-16(P-P)}$	Note 1	3	–	4	V
Permissible Superimposed Noise Signal (Peak-to-Peak Value)	$V_{10-16(P-P)}$		–	–	7	V
<b>Line Flyback Pulse</b>						
Input Current	$I_6$		0.02	1	2	mA
Input Switching Voltage	$V_{6-16}$		–	1.4	–	V
Input Limiting Voltage	$V_{6-16}$		–0.7	–	+1.4	V
<b>Switching on VCR</b>						
Input Voltage	$V_{11-16}$		0 to 2.5			V
			9 to $V_{1-16}$			V
Input Current	$-I_{11}$		–	–	200	$\mu\text{A}$
	$I_{11}$		–	–	2	mA
<b>Pulse Duration Switch [t = 7<math>\mu\text{s}</math> (Thyristor Driving)]</b>						
Input Voltage	$V_{4-16}$		–	9.4 to $V_{1-16}$	–	V
Input Current	$I_4$		200	–	–	$\mu\text{A}$
<b>Pulse Duration Switch [t = 14<math>\mu\text{s}</math> + <math>t_D</math> (Transistor Driving)]</b>						
Input Voltage	$V_{4-16}$		0	–	3.5	V
Input Current	$-I_4$		200	–	–	$\mu\text{A}$

Note 1. Permissible Range 1V to 7V.

**DC and AC Electrical Characteristics (Cont'd):** ( $V_{CC} = 12V$ ,  $T_A = +25^\circ C$  unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>Pulse Duration Switch</b> ( $t = 0$ , $V_{3-16} = 0$ or Input Pin4 Open)						
Input Voltage	$V_{4-16}$		5.4	–	6.6	V
Input Current	$I_4$		–	0	0	$\mu A$
<b>Vertical Sync Pulse</b> (Positive-Going)						
Output Voltage (Peak-to-Peak Value)	$V_{8-16(P-P)}$		10	11	–	V
Output Resistance	$R_8$		–	2	–	$k\Omega$
Delay Between Leading Edge of Input and Output Signal	$t_{ON}$		–	15	–	$\mu s$
Delay Between Trailing Edge of Input and Output Signal	$t_{OFF}$		–	$t_{ON}$	–	$\mu s$
<b>Burst Gating Pulse</b> (Positive-Going)						
Output Voltage (Peak-to-Peak Value)	$V_{7-16(P-P)}$		10	11	–	V
Output Resistance	$R_7$		–	70	–	$\Omega$
Pulse Duration	$t_p$	$V_{7-16} = 7V$	– 3.7	4.0 4.3	– –	$\mu s$ $\mu s$
Phase Relation Between Middle of Sync Pulse at the Input and the Leading Edge of the Burst Gating Pulse	$t$	$V_{7-16} = 7V$	2.15	2.65	3.15	$\mu s$
Output Trailing Edge Current	$I_7$		–	2	–	mA
<b>Line Flyback-Blanking Pulse</b> (Positive-Going)						
Output Voltage (Peak-to-Peak Value)	$V_{7-16(P-P)}$		4	5	–	V
Output Resistance	$R_7$		–	70	–	$\Omega$
Output Trailing Edge Current	$I_7$		–	2	–	mA
<b>Line Drive Pulse</b> (Positive-Going)						
Output Voltage (Peak-to-Peak Value)	$V_{3-16(P-P)}$		–	10.5	–	V
Output Resistance for Leading Edge of Line Pulse	$R_3$		–	2.5	–	$\Omega$
Output Resistance for Trailing Edge of Line Pulse	$R_3$		–	20	–	$\Omega$
Pulse Duration (Thyristor Driving)	$t_p$	$V_{4-16} = 9.4$ to $V_{1-16}V$	5.5	7.0	8.5	$\mu s$
Pulse Duration (Transistor Driving)	$t_p$	$V_{4-16} = 0$ to $4V$ , $t_{FP} = 12\mu s$ , Note 2	–	$14 + t_D$	–	$\mu s$
Supply Voltage for Switching OFF the Output Pulse	$V_{1-16}$		–	4	–	V
<b>Overall Phase Relation</b>						
Phase Relation Between Middle of Sync Pulse and the Middle of the Flyback Pulse	$t$	Note 3	–	2.6	–	$\mu s$
Tolerance of Phase Relation	$ \Delta t $		–	–	0.7	$\mu s$
The Adjustment of the Overall Phase Relation and Consequently the Leading Edge of the Line Drive Occurs Automatically by Phase Control $\phi_2$ . If Additional Adjustment is Applied it can be Arranged by Current Supply at Pin5.	$\Delta I_s/\Delta t$		–	30	–	$\mu A/\mu s$

Note 2.  $t_D$  = Switch-OFF Delay of Line Output Stage.

Note 3. Line Flyback Pulse Duration  $t_{FP} = 12\mu s$ .

**DC and AC Electrical Characteristics (Cont'd):** ( $V_{CC} = 12V$ ,  $T_A = +25^{\circ}C$  unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>Oscillator</b>						
Threshold Voltage Low Level	$V_{14-16}$		–	4.4	–	V
Threshold Voltage High Level	$V_{14-16}$		–	7.6	–	V
Discharge Current	$\pm I_{14}$		–	0.47	–	mA
Frequency; Free Running	$f_O$	$C_{OSC} = 4.7nF$ , $R_{OSC} = 12k\Omega$	–	15.625	–	kHz
Spread of Frequency	$\Delta f_O/f_O$	Note 4	–	$< \pm 5$	–	%
Frequency Control Sensitivity	$\Delta f_O/\Delta I_{15}$		–	31	–	Hz/ $\mu A$
Adjustment Range of Network in Circuit	$\Delta f_O/f_O$		–	$\pm 10$	–	%
Influence of Supply Voltage on Frequency	$\frac{\Delta f_O/f_O}{\Delta V/V_{NOM}}$	Note 4	–	$< \pm 0.05$	–	%
Change of Frequency when $V_{1-16}$ Drops to 5V	$\Delta f_O$	Note 4	–	$< \pm 10$	–	%
Temperature Coefficient of Oscillator Frequency		Note 4	–	$< \pm 10^{-4}$	–	Hz/ $^{\circ}C$
<b>Phase Comparison <math>\phi_1</math></b>						
Control Voltage Range	$V_{13-16}$		3.8	8.2	–	V
Control Current (Peak Value)	$\pm I_{13M}$		1.9	2.3	–	mA
Output Leakage Current	$I_{13}$	$V_{13-16} = 4$ to $8V$	–	–	1	$\mu A$
Output Resistance	$R_{13}$	$V_{13-16} = 4$ to $8V$ , Note 5	High Ohmic			
		$V_{13-16} < 3.8V$ or $> 8.2V$ , Note 6	Low Ohmic			
Control Sensitivity			–	2	–	kHz/ $\mu s$
Catching and Holding Range	$\Delta f$	$82k\Omega$ Between Pins 13 and 15	–	$\pm 780$	–	Hz
Spread of Catching and Holding Range	$\Delta(\Delta f)$	Note 4	–	$\pm 10$	–	%
<b>Phase Comparison <math>\phi_2</math> and Phase Shifter</b>						
Control Voltage range	$V_{5-16}$		5.4	–	7.6	V
Control Current (Peak Value)	$\pm I_{5M}$		–	1	–	mA
Output Resistance	$R_5$	$V_{5-16} = 5.4$ to $7.6V$ , Note 7	High Ohmic			
		$V_{5-16} < 5.4$ or $> 7.6V$	–	8	–	k $\Omega$
Input Leakage Current	$I_5$	$V_{5-16} = 5.4$ to $7.6V$	–	–	5	$\mu A$
Permissible Delay Between Leading Edge of Output Pulse and Leading Edge of Flyback Pulse	$t_D$	$t_{FP} = 12\mu s$	–	–	15	$\mu s$
Static Control Error	$\Delta t/\Delta t_D$		–	–	0.2	%
<b>Coincidence Detector <math>\phi_3</math></b>						
Output Voltage	$V_{11-16}$		0.5	0	6.0	V
Output Current (Peak Value)	$I_{11M}$	Without Coincidence	–	0.1	–	mA
	$-I_{11M}$	With Coincidence	–	0.5	–	mA
<b>Time Constant Switch</b>						
Output Voltage	$V_{12-16}$		–	6	–	V
Output Current (Limited)	$\pm I_{12}$		–	–	1	mA
Output Resistance	$R_{12}$	$V_{11-16} = 2.5$ to $7V$	–	0.1	–	k $\Omega$
		$V_{11-16} < 1.5V$ or $> 9V$	–	60	–	k $\Omega$

**DC and AC Electrical Characteristics (Cont'd):** ( $V_{CC} = 12V$ ,  $T_A = +25^{\circ}C$  unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>Internal Gating Pulse</b>						
Pulse Duration	$t_p$		–	7.5	–	$\mu s$

Note 4. Excluding External Component Tolerances.

Note 5. Current Source.

Note 6. Emitter-Follower.

Note 7. Current Source.

**Pin Connection Diagram**

