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## **NTE874 Integrated Circuit TV Horiz/Vert Countdown System Circuit**

**Description:**

The NTE874 is a monolithic bipolar/I<sup>2</sup>L integrated circuit digital sync system designed for use in consumer TV applications for color/monochrome receivers or monitors. This device takes the composite video input signal in combination with the on-chip master-scan oscillator to provide both horizontal drive and vertical deflection output signals.

Other on-chip functions include sync separator, horizontal APC, horizontal/vertical count-down circuitry, vertical ramp generator, and horizontal drive circuit (Pulse-Width Modulator).

The NTE874 features dual-mode operation and accepts either standard or non-standard video signals. An automatic mode-recognition system forces the operation into the asynchronous mode for non-standard sync signals.

Intended for use with 525-line systems, the NTE874 is supplied in the 28-lead dual-in-line plastic package.

**Features:**

- Sync Separator
- Master Scan Oscillator (at 64 X f<sub>H</sub>)
- Automatic Phase Control (APC) of Oscillator
- Horizontal/Vertical Count-down
- Vertical Output
- Horizontal Drive Output (Pulse-Width Modulator)

**Absolute Maximum Ratings:**

**POWER SUPPLY:**

Power Supply Voltage, V <sub>CC</sub> .....	15V
Power Supply Current, I <sub>CC</sub> .....	75mA
Injector Supply Voltage, V <sub>INJ</sub> .....	1.75V
Injector Supply Current, I <sub>INJ</sub> .....	150mA

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

**INPUTS OUTPUTS:**

AGC Gate (Pin 9) Source, $I_{EAGC}$ .....	10mA
Composite Blanking (Pin 16) Sink, $I_{CBLNK}$ .....	10mA
Horizontal Drive (Pin 5) Sink, $I_{CHD}$ .....	50mA
Horizontal Output (Pin 3) Sink, $I_{CHO}$ .....	30mA
Sync Separator Out (Pin 28), $I_{SYNC}$ .....	30mA
Vertical Drive (Pin 14) Source, $I_{VERT}$ .....	50mA

**DEVICE DISSIPATION:**

Maximum Rated Junction Temperature, $T_{JMAX}$ .....	+150°C
Maximum Power Dissipation, $P_D$	
Up to $T_A = +50^\circ C$ .....	1.1W
Above $T_A = +50^\circ C$ .....	Derate linearly at 11.1 mW/°C

**AMBIENT TEMPERATURE RANGE:**

Operating, $T_{OP}$ .....	0° to +85°C
Storage, $T_{STG}$ .....	-55° to +150°C

**LEAD TEMPERATURE (DURING SOLDERING):**

At distance $1/16 \pm 1/32$ in. ( $1.59 \pm 0.79$ mm) from case for 10s max. ....	+265°C
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**Standard Operating Range:**

Parameter	Symbol	PIN #	Min	Typ	Max	Units
Analog Supply Voltage	$V_{CC}$	7	10.9	12.0	12.9	V
Analog Supply Current	$I_{CC}$	7	30	45	60	mA
Injector Supply Voltage	$V_{INJ}$	10	1.3	1.6	1.9	V
Total Dissipation, no external loads	$P_D$	-	-	580	-	mW
Force Asynchronous Low ("0")	$V_{FAL}$	2	-0.5	0	+0.25	V
Force Asynchronous	$V_{FAH}$	2	0.7	0.8	1.5	V
Integrated Vertical, Low	$V_{IVL}$	1	-	-	1.9	V
Integrated Vertical, High	$V_{IVH}$	1	2.8	-	-	V

**Electrical Characteristics:** ( $T_A = +25^\circ C$ ,  $V_{CC} = 12V_{DC}$ ,  $V_{25} = 12V_{DC}$ , Pin 2, 15, 22 to GND;  $1\mu F$  from Pin 4 to GND., 10K ohms from Pin 28 to GND.,  $F_{CLK} = 1MHz$ , (AC Coupled),  $V_{Sync} 1.2V$  to 4V,  $V_{IV} 1.9V$  to 2.8V,  $V_{FA} 0.2V$  to 0.7V)

Parameter	Test Conditions	PIN #	Min	Typ	Max	Units
<b>Power Supply Section</b>						
Supply Current	Pin 10 Open	7	20	45	60	mA
Injector Voltage		10	1.3	1.6	1.9	V
<b>Sync Separator/Diff. Section</b>						
Video Inverter, High Voltage	$V_{27} = 4V$ , $I_{26} = -500\mu A$	26	4.2	5.1	5.8	V
Sync Processor, Low Voltage	$V_{27} = 4V$ , $I_{26} = 0\mu A$	28	-	-	.1	V
<b>OSC/Count-Down/APC Section</b>						
APC Bias	$V_{27} = 4V$ , $I_{26} = 0\mu A$ , $V_{21} = Open$	21	6.5	6.8	7.5	V

**Electrical Characteristics (Cont'd):** ( $T_A = +25^\circ\text{C}$ ,  $V_{CC} = 12V_{DC}$ ,  $V_{25} = 12V_{DC}$ , Pin 2, 15, 22 to GND.,  $1\mu\text{F}$  from Pin 4 to GND.,  $10\text{K}$  ohms from Pin 28 to GND.,  $F_{CLK} = 1\text{MHz}$ , (AC Coupled),  $V_{Sync} = 1.2\text{V}$  to  $4\text{V}$ ,  $V_{IV} = 1.9\text{V}$  to  $2.8\text{V}$ ,  $V_{FA} = 0.2\text{V}$  to  $0.7\text{V}$ )

Parameter	Test Conditions	PIN #	Min	Typ	Max	Units
<b>OSC/Count-Down/APC Section (Cont'd)</b>						
APC Discharge	$V_{27} = 4\text{V}$ , $I_{26} = 0\mu\text{A}$ , $V_{21} = \text{Open}$	21	6.5	6.8	7.5	V
APC Discharge	$I_{26} = -500\mu\text{A}$ , $V_{20} = 2\text{V}$ , $V_{21} = 2\text{V}$ , $V_{21} = V_{APC}$ Bias (above), (Stop Clock When Pin 21 Goes Low)	21	600	803	1100	$\mu\text{A}$
APC Charge	$V_{27} = 4\text{V}$ , $I_{26} = -500\mu\text{A}$ , $V_{20} = 6\text{V}$ , $V_{21} = V_{APC}$ Bias (above)	21	-600	-793	-1100	$\mu\text{A}$
Phase Detector	$I_{21} = \text{APC Discharge-APC Charge}$	21	-30	9.8	30	$\mu\text{A}$
Sync Width, Wide Differentiation	$V_{27} = 5\text{V}$ , $V_{23} = 1\text{MHz}$ , $I_{20} = -300\mu\text{A}$ , $V_{26} = \text{Sq. Wave } 0 \text{ to } 5\text{V}$ with $T_{on} = T_{off} = 31.75\mu\text{s}$	21	5	6	8	$\mu\text{s}$
Sync Width, Narrow	Same as above except $T_{on} = 2\mu\text{s}$ , $T_{off} = 61.5\mu\text{s}$	21	1.8	2.3	2.6	$\mu\text{s}$
Phase Detector Bias	$V_{27} = 4\text{V}$	20	3.9	4.3	4.7	V
Oscillator Current 1	$V_{24} = 3\text{V}$ , $V_{23} = 6\text{V}$ $V_{21} = 8.5\text{V}$	25	1.4	1.8	3.0	mA
<b>OSC/Count-Down/APC Section</b>						
Oscillator Current Ratio	$V_{24} = 3\text{V}$ , $V_{23} = 6\text{V}$ , $V_{21} = \text{Open}$ , Measured $I_{25}$ & Divide by Oscillator Current 1	25	.45	.5	.55	Ratio
Oscillator Bias		24	4.5	4.8	5.5	V
+Phase Input Current	$V_{24} = 0\text{V}$	24	-230	312	-570	$\mu\text{A}$
-Phase Input Current	$V_{23} = 0\text{V}$	23	-230	331	-570	$\mu\text{A}$
Flyback Charge Current	$V_{17} = 0\text{V}$ , $V_{19} = 6\text{V}$	19	-400	-501	-766	$\mu\text{A}$
Flyback Discharge Current	$I_{17} = 700\mu\text{A}$ , $V_{19} = 6\text{V}$	19	2	2.4	3.5	mA
<b>Blanking/Gating Section</b>						
Flyback Input, Low Current 1	$V_{18} = 0\text{V}$	18	-3	-1	3	$\mu\text{A}$
Flyback Input, High Current 1	$V_{18} = 2\text{V}$	18	0.8	1.6	3.8	mA
Flyback Input, Low Current 2	$V_{17} = 0\text{V}$	17	-3	-.09	3	$\mu\text{A}$
Flyback Input, High Current 2	$V_{17} = 2\text{V}$	17	0.8	1.5	1.9	mA
Blanking Voltage	$V_{18} = 2\text{V}$ , $V_{23} = 1\text{MHz}$ , Stop Clock when $3\text{V} < V_{16} < 5\text{V}$	16	5.8	6	6.4	V
Burst Voltage	$V_{18} = 2\text{V}$ , $V_{23} = 1\text{MHz}$ , Stop Clock when $V_{16} > 9\text{V}$	16	11.2	11.95	-	V
Burst Saturation Voltage	$V_{18} = 0\text{V}$ $I_{16} = 5\mu\text{A}$	16	-	.45	0.6	V

**Electrical Characteristics (Cont'd):** ( $T_A = +25^\circ\text{C}$ ,  $V_{CC} = 12V_{DC}$ ,  $V_{25} = 12V_{DC}$ , Pin 2, 15, 22 to GND,;  $1\mu\text{F}$  from Pin 4 to GND.,  $10\text{K}$  ohms from Pin 28 to GND.,  $F_{CLK} = 1\text{MHz}$ , (AC Coupled),  $V_{Sync} 1.2\text{V}$  to  $4\text{V}$ ,  $V_{IV} 1.9\text{V}$  to  $2.8\text{V}$ ,  $V_{FA} 0.2\text{V}$  to  $0.7\text{V}$ )

Parameter	Test Conditions	PIN #	Min	Typ	Max	Units
<b>Blanking/Gating Section (Cont'd)</b>						
Horizontal Blanking Starts	(See Notes: 1, 2, 4)	16	–	.07	0.6	$\mu\text{s}$
Horizontal Blanking Width	(See Notes: 2, 4, 5)	16	11.75	12.3	12.75	$\mu\text{s}$
Burst Gate Starts	(See Notes: 1, 2, 4)	16	0.15	.44	0.45	$\mu\text{s}$
Burst Gate Trailing Edge	(See Notes: 1, 2, 4)	16	8.6	–	9.8	$\mu\text{s}$
AGC Gate Starts	(See Notes: 1, 2, 4)	9	–	.37	0.9	$\mu\text{s}$
AGC Gate Width 1	(See Notes: 2, 4, 5)	9	4.25	5.3	6.25	$\mu\text{s}$
AGC Gate Width 2	(See Notes: 3, 4, 5)	9	4.25	5.2	6.25	$\mu\text{s}$
<b>Horizontal Drive Section</b>						
Horizontal Out, Low Voltage Start	$V_{CC} = 3\text{V}$ , $50\text{pF}$ (Pin 3 to GND), $3.9\text{K-ohm}$ (Pin 3 to $3\text{V}$ )	3	2.8	–	–	$V_{p-p}$
Low Voltage Horizontal Period	$V_{CC} = 3\text{V}$ , $V_{23} = 1\text{MHz}$ , $50\text{pF}$ (Pin 3 to GND), $3.9\text{K-ohm}$ (Pin 3 to $3\text{V}$ ) (Trigger Level $1.5\text{V}$ )	3	55	64	75	$\mu\text{s}$
Low Voltage Horizontal Pulse Width Symmetry	$V_{CC} = 3\text{V}$ , $V_{23} = 1\text{MHz}$ , $50\text{pF}$ (Pin 3 to GND), $3.9\text{K-ohm}$ (Pin 3 to $3\text{V}$ ) (Trigger Level $1.5\text{V}$ ) Find Pulse Width Divide by Period	3	.3	.48	.7	Ratio
Pin 4 Quiescent Voltage	$V_6 = V_8 = 6\text{V}$ , $I_5 = 20\text{mA}$ , Pin 4 Open		8.4	8.7	9.1	V
Horizontal Drive Saturation Voltage	$V_6 = V_8 = 6\text{V}$	5	–	174	225	mV
Horizontal Drive Symmetry	$V_6 = V_8 = 6\text{V}$ , $200\text{ ohm}$ (Pin 5 to GND), $600\text{ ohm}$ (Pin 5 to $V_{CC}$ ), $V_4 = 15$ , $734\text{Hz}$ , $2V_{p-p}$	5	26	29.5	33	$\mu\text{s}$
Horizontal Drive Ratio		3	–	64	–	$\mu\text{s}$
Horizontal Pulse Width		3	31	–	33	$\mu\text{s}$
<b>Vertical Drive Section</b>						
Ramp Leakage	$V_{12} = 0\text{V}$ , $V_{11} = 1\text{V}$ , $V_{13} = 4\text{V}$	11	–	.04	–3	$\mu\text{A}$
Mirror Ramp Current	$I_{12} = 150\mu\text{A}$ , $V_{11} = 4\text{V}$ , $V_{13} = 5\text{V}$	11	–	.04	–3	$\mu\text{A}$
Ramp Charging Current, VD High	$V_{12} = 0\text{V}$ , $V_{11} = 0\text{V}$ , $V_{13} = 5\text{V}$ , Stop Clock when Pin 11 Goes High	11	–5.5	–10	–15.5	mA

**Electrical Characteristics (Cont'd):** ( $T_A = +25^\circ\text{C}$ ,  $V_{CC} = 12V_{DC}$ ,  $V_{25} = 12V_{DC}$ , Pin 2, 15, 22 to GND,  $1\mu\text{F}$  from Pin 4 to GND., 10K ohms from Pin 28 to GND.,  $F_{CLK} = 1\text{MHz}$ , (AC Coupled),  $V_{Sync} 1.2\text{V}$  to  $4\text{V}$ ,  $V_{IV} 1.9\text{V}$  to  $2.8\text{V}$ ,  $V_{FA} 0.2\text{V}$  to  $0.7\text{V}$ )

Parameter	Test Conditions	PIN #	Min	Typ	Max	Units
<b>Vertical Drive Section (Cont'd)</b>						
Amplifier Input Voltage Range, VD Low	100ohm (Pin 14 to GND) V13 = 1.7V, Set V11 for V14 = 2V Record V11, 13; Then V13 = 4V Record V11, 13; Find Difference Stop Clock When Pin Goes Low	11,13	–	–	50	mV
Vertical, On–State Voltage	V12 = 0V, V11 = 3V, V13 = 5V, I14 = –45 mA	14	1.4	–	–	V
Vertical, Off–State Current	V12 = 0V, V11 = 4V, V13 = 3V, V14 = 5V	14	–	–	2	$\mu\text{A}$
Open Loop, Small Signal Voltage Gain	100 ohm (Pin 14 to GND) V13 = 2V Set V11 thru 1K ohm for V14 = 2V Apply 1kHz, $1V_{RMS}$ to Pin 11 Thru 99 K ohm and $1\mu\text{F}$ $A_{vol} = 20 \text{ LOG} V_{14}(\text{AC})/V_{11}(\text{AC}) $	11,14	24	33	39	dB
Mode Change Non–Standard IV Field Count STD/NON–STD	Sync = 9, Within IV Window (See Note 6)	11,16	5	–	7	–
Mode Change Non–Standard Vertical Sync Field Count STD/NON–STD	Sync = Less than 9	11,16	5	–	7	–
Mode Change Field Confidence Count, NON–STD/STD	Number of New Timing IV/Sync Periods to Return to STD Mode	11,16	7	–	14	–
Standard Mode Divide Ratio	IV = 16800 Clock Ratio Sync = 9 ) Serrations within 384 Clock Window (After 8 Fields, i.e: On 9th Field)	–	–	–	16800	
Standard Mode Vertical Pulse Width	(See Note 7) Number of Clock Cycles Output is On	11	383	384	387	–
Non–Standard Mode	IV Ratio Range Can Be and Cause Proper Synchronization, Except for IV Ratio Range of (16748–16832), Sync = Don't Care (After 7 Fields, i.e.: on 8th Field)	–	16160	–	17405	
Non–Standard Vertical Pulse Width	Number of Clock Cycles Output is On	11	362	364	367	–

**Electrical Characteristics (Cont'd):** ( $T_A = +25^\circ\text{C}$ ,  $V_{CC} = 12V_{DC}$ ,  $V_{25} = 12V_{DC}$ , Pin 2, 15, 22 to GND;,  $1\mu\text{F}$  from Pin 4 to GND.,  $10\text{K}$  ohms from Pin 28 to GND.,  $F_{CLK} = 1\text{MHz}$ , (AC Coupled),  $V_{Sync} 1.2\text{V}$  to  $4\text{V}$ ,  $V_{IV} 1.9\text{V}$  to  $2.8\text{V}$ ,  $V_{FA} 0.2\text{V}$  to  $0.7\text{V}$ )

Parameter	Test Conditions	PIN #	Min	Typ	Max	Units
<b>Vertical Drive Section (Cont'd)</b>						
Non-Standard Vertical Pulse Width	Sync 9 Serrations Within 384 Clock Window, Number of Clock Cycles Output is On	11	362	364	367	–
Non-Standard Mode Asynchronous Divide Ratio	No IV or Sync Applied (After 7 Fields, i.e., on 8th Field)	11, 16	–	–	21888	–
Blanking Pulse Width	–	16	1200	1216	1220	–
Noise Mode Change	IV Outside the Range of (16784–16832) Sync = 9 Serrations in 384 Clock Window Pulse Applied 2432 to 11520 After an IV, Pulse is 8 to 32 Clocks Wide. Resync results in next field and is maintained for Mode Change Confidence Count	11,16	–	–	16800	–
Force Non-Standard Mode	IV = 16800 Sync = 9 Serrations Within 384 Clock Window. VFA Open Circuit Vertical Pulse Width M Measured in Next Field.	11	362	364	367	$\mu\text{s}$

Note 1 All timing measurements are with reference to the leading edge of the fly-back pulse input to Pin 18. Fly-back pulse width is  $12.00\ \mu\text{s}$  and it is from 0 to 5V. Fly-back pulse train should start about  $500\ \mu\text{s}$  after the start of vertical drive pulse.

Note 2 Start of fly-back pulse is 90 degrees leading with clock.

Note 3 Start of fly-back pulse is 90 degrees lagging with clock.

Note 4 Threshold for measuring AGC gate and horizontal blanking is 3V and burst gate is at 9V.

Note 5. Timing measurements referenced to trailing edge of negative sync pulse input to Pin 26. The negative sync pulse width is  $4.5\ \mu\text{s}$  and is from 0 to  $500\ \mu\text{A}$ , with negative leading edge delayed  $0.5\ \mu\text{s}$  from the positive leading edge of the fly-back pulse. The input to Pin 27 is  $+4V_{DC}$ .

Note 6 IV Ratio same as in Non-Standard Mode Ratio Range Test.

Note 7 IV Ratio same as in Standard Mode Ratio Test.

Note 8 Burst Gate Start is with reference to trailing edge of sync pulse at Pin 26. Sync Pulse is a  $500\ \mu\text{A}$  Sink Current at Pin 26.

### Pin Connection Diagram

Integrated Vert Input	<b>1</b>	<b>28</b>	Sync Output
Mode Select	<b>2</b>	<b>27</b>	Composite Video Input
Horiz Output	<b>3</b>	<b>26</b>	Sync Sep Filter
Horiz Sawtooth Input	<b>4</b>	<b>25</b>	OSC Tank
Horiz Drive Output	<b>5</b>	<b>24</b>	OSC Tank Lag Input
B+ Adjust Ref	<b>6</b>	<b>23</b>	OSC tank Lead Input
V <sub>CC</sub>	<b>7</b>	<b>22</b>	GND
Beam Current Feedback Ref	<b>8</b>	<b>21</b>	APC Filter
AGC Gate Output	<b>9</b>	<b>20</b>	Flyback Sawtooth Ramp
Shunt Reg	<b>10</b>	<b>19</b>	Flyback Sawtooth Filter
Vert Ramp Shape	<b>11</b>	<b>18</b>	Flyback Input 1
Vert Height Adjust	<b>12</b>	<b>17</b>	Flyback Input 2
Vert Feedback	<b>13</b>	<b>16</b>	Sandcastle Output
Vert Output	<b>14</b>	<b>15</b>	Vert GND

