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# NTE7150 Integrated Circuit Video, Chroma, and Sync. Signal Processing Circuit for PAL/NTSC/SECAM System Color Televisions

## Description:

The NTE7150 is an integrated circuit in a 64-Lead SIP type package designed for PAL/NTSC/SECAM system color televisions involving video, chroma, and sync. signal processing circuits.

The video section contains a high-performance picture quality emphasis circuit, the chroma section contains a PAL/NTSC/SECAM system automatic identification circuit, and the sync. section contains a 50/60Hz automatic identification circuit. The PAL/SECAM demodulating circuit uses a baseband signal processing system, providing an adjustment-free demodulating circuit. User control functions, system switching, etc. are controlled via the I<sup>2</sup>C bus.

## Features:

### Video Section

- Sharpness Control with Internal Delay Lines
- Black Stretching Circuit
- YNR
- Variable DC Restoration Ratio
- Gamma ( $\gamma$ ) Contrast Correction

### Chroma Section

- PAL/SECAM baseband Demodulation System
- Automatic Crystal Frequency Identification (4.43MHz/3.58MHz/M, N-PAL)
- Automatic Chroma System Identification (PAL/NTSC/SECAM)
- PLL SECAM Adjustment-Free Demodulation Circuit without and Tank Coils
- Built-In SECAM BELL Filter

### Sync. Section

- Adjustment-Free Horizontal and Vertical Oscillation Circuits based on Countdown System
- Automatic Vertical Frequency Identification (50/60Hz)

## Absolute Maximum Ratings: (T<sub>A</sub> = +25°C unless otherwise specified)

Supply Voltage, V <sub>CC</sub> .....	15V
Power Dissipation, P <sub>Dmax</sub> .....	2660mW
Derate Above 25°C .....	21.2mW/°C
Input Signal Amplitude, e <sub>in</sub> .....	5V <sub>P-P</sub>
Applied Voltage, E <sub>in</sub> .....	GND-0.3V to V <sub>CC</sub> +0.3V
Operating Temperature Range, T <sub>opr</sub> .....	-20° to +65°C
Storage Temperature Range, T <sub>stg</sub> .....	-55° to +150°C

## Recommended Operating Conditions:

Parameter	Test Conditions	Min	Typ	Max	Unit
Supply Voltage	At Pin19, Pin36, Pin50, and Pin59	8.1	9.0	9.5	V
	At Pin5	8.1	9.0	10.0	V
	At Pin4	3.0	3.3	3.6	V

### Recommended Operating Conditions (Cont'd):

Parameter	Test Conditions	Min	Typ	Max	Unit
Video Input Signal Level	Composite Video Signal Amplitude	0.7	1.0	1.2	V <sub>P-P</sub>
Chroma Input Signal Level	PAL/NTSC Chroma Input	100	200	300	mV <sub>P-P</sub>
	SECAM Chroma Input	50	100	150	mV <sub>P-P</sub>
Sync Input Signal Level	Composite Video Signal Amplitude	1.0	2.0	2.5	V <sub>P-P</sub>
Text Input Signal Level		0.5	0.7	1.0	V <sub>P-P</sub>
FBP Width		11	12	13	μs
FBP Input Current		0.3	1.0	1.3	mA
RGB Output Current		–	1.0	2.0	mA
H. Out Output Current		–	3.0	5.0	mA
V <sub>P</sub> Output Current		–	1.0	2.0	mA

### DC Characteristics: V<sub>CC</sub> = 9V, Logic V<sub>CC</sub> = 3.3V, T<sub>A</sub> = +25°C unless otherwise specified)

Parameter	Test Conditions	Min	Typ	Max	Unit	
Supply Current	Logic V <sub>CC</sub> (Pin4) = 3.3V		10	20	28	mA
		Video/Chroma V <sub>CC</sub> Turned OFF	15	30	40	mA
	H. V <sub>CC</sub> (Pin5) = 9V		10	20	28	mA
		Video/Chroma V <sub>CC</sub> Turned OFF	15	30	40	mA
	TEXT Section V <sub>CC</sub> (Pin19) = 9V	15	31	44	mA	
	SECAM Section V <sub>CC</sub> (Pin36) = 9V	10	18	25	mA	
	Chroma Section V <sub>CC</sub> (Pin50) = 9V	12	27	38	mA	
	Video Section V <sub>CC</sub> (Pin59) = 9V	17	37	52	mA	
Terminal Voltage	Pin2	7.2	7.4	7.8	V	
	Pin16, Pin17, and Pin18 (In Mute Mode)	1.7	2.0	2.3	V	
	Pin22, Pin23, and Pin24 (Uni-Color DAC center)	3.3	3.8	4.2	V	
	Pin63 (Apply 5V with 5.1kΩ Resistor, Measure DC Output Voltage at Trace Period)	3.1	3.5	3.9	V	

### AC Characteristics: V<sub>CC</sub> = 9V, Logic V<sub>CC</sub> = 3.3V, T<sub>A</sub> = +25°C unless otherwise specified)

Parameter	Test Conditions	Min	Typ	Max	Unit	
<b>Video Section</b>						
Y Input Dynamic Range	Measure dynamic range above the pedestal level	Upper	0.7	1.0	1.3	V <sub>P-P</sub>
		Lower	0.0	0.3	0.5	V <sub>P-P</sub>
Y Input Impedance	Measure input impedance of Pin60	100	130	–	kΩ	
Y Input Clamp Voltage	Measure DC voltage at Pin60 when Y input connected to AC GND.	2.5	2.8	3.1	V	
Maximum Y Gain		15.0	17.5	23.0	dB	
Y Frequency Bandwidth		8	10	15	MHz	
Black Stretching Amp Maximum Gain		1.3	1.4	1.5		
Black Stretching Start Point		40	50	65	IRE	
DC Restoration Ratio		97	100	103	%	
Black Stretching Start Voltage		3.2	3.3	3.6	V	
Delay Time of Sharpness Circuit	Measure difference in Y output signal delay time between sharpness SW turned ON and OFF.	115	125	135	ns	

**AC Characteristics (Cont'd):**  $V_{CC} = 9V$ , Logic  $V_{CC} = 3.3V$ ,  $T_A = +25^{\circ}C$  unless otherwise specified)

Parameter	Test Conditions	Min	Typ	Max	Unit
<b>Video Section (Cont'd)</b>					
Sharpness Control Maximum Gain	Input 2T pulse VBS to TP60 and TP63. Measure 2T pulse output gain of data = 3FH, 20H, and 00H. 0dB is equal to the output gain of sharpness SW OFF.	3.5	5.5	7.5	dB
Center Gain		0.5	1.5	3.5	dB
Minumim Gain		-3	-1	+1	dB
YNR Gain		-20	-13	-8	dB
Contact Control Center Gain	Measure Y output gain of data = 40H and 00H. Maximum Y gain is 0dB.	-4.0	-5.5	-7.0	dB
Minimum Gain		-17	-19	-21	dB
$\gamma$ Point $V_a$		40	50	60	IRE
$V_b$		80	90	100	IRE
$\gamma$ Gain $G_a$		-1	-3	-5	dB
$G_b$		-4	-6	-8	dB
Y Signal to Noise Ratio		50	55	60	dB
<b>Chroma Section 1 (PAL/NTSC)</b>					
ACC Output Characteristics e300	Input rainbow signal whose burst and chroma signal level is 300mV <sub>P-P</sub> and 100mV <sub>P-P</sub> . Measure sugnal amplitude at Pin41.	260	370	520	mV <sub>P-P</sub>
e100		260	370	520	mV <sub>P-P</sub>
ACC Flatness	3300/e100	0.9	1.0	1.1	
Killer-On Level PAL	Input color bar signal. Measure burst amplitude at which color begins to disappear when burst is gradually reduced.	0.2	0.5	1.0	mV <sub>P-P</sub>
NTSC		0.2	0.5	1.0	mV <sub>P-P</sub>
Killer-Off Level PAL	Input color bar signal. Measure burst amplitude at which color begins to be tinted when burst is gradually increased from 0.	1.0	2.5	4.0	mV <sub>P-P</sub>
NTSC		1.0	2.5	4.0	mV <sub>P-P</sub>
APC Pull-In Range 3.58MHz	$f_o = 3.579545MHz$	$\pm 300$	$\pm 500$	$\pm 1000$	Hz
4.43MHz	$f_o = 4.433619MHz$	$\pm 300$	$\pm 500$	$\pm 1000$	Hz
M PAL	$f_o = 3.575611MHz$	$\pm 300$	$\pm 500$	$\pm 1000$	Hz
VCXO Freq Control Sensitivity 4.43MHz	Fix X-tal mode with bus. Measure frequency changes at TP28 when varying TP26 voltage from 6.2V to 6.3V.	1.7	2.4	3.2	Hz/mV
3.58MHz		1.5	2.2	3.0	Hz/mV
M PAL		1.8	2.5	3.3	Hz/mV
$f_{sc}$ Output Amplitude 4.43MHz	Fix X'tal mode with bus. Measure signal amplitude at TP28.	130	150	170	mV <sub>P-P</sub>
3.58MHz		120	140	160	mV <sub>P-P</sub>
$f_{sc}$ Output Voltage 4.43MHz	Fix X'tal mode with bus. Measure DC voltage at TP28.	3.6	3.9	4.2	V
3.58MHz		2.8	3.1	3.4	v
B-Y Output Amplitude 4PAL	Input rainbow signal. Measure signal amplitude at Pin41.	260	370	520	mV <sub>P-P</sub>
3NTSC		260	370	520	mV <sub>P-P</sub>

**AC Characteristics (Cont'd):**  $V_{CC} = 9V$ , Logic  $V_{CC} = 3.3V$ ,  $T_A = +25^\circ C$  unless otherwise specified)

Parameter	Test Conditions	Min	Typ	Max	Unit
<b>Chroma Section 1 (Cont'd) (PAL/NTSC)</b>					
R-Y Output Amplitude 4PAL	Input rainbow signal. Measure signal amplitude at Pin40.	220	315	440	mV <sub>P-P</sub>
3NTSC		220	315	440	mV <sub>P-P</sub>
Relative Amplitude 4PAL	Input rainbow signal. Measure (R-Y)/(B-Y).	0.73	0.8	0.9	
3NTSC		0.73	0.8	0.9	
Relative Phase 4PAL/4NTSC	Input rainbow signal. Measure $\theta(R-Y)/\theta(B-Y)$ .	85	90	95	DEG
3NTSC		85	90	95	DEG
Chroma Demodulation Bandwidth		0.5	0.8	1.5	MHz
Residual Carrier Level B-Y	Measure residual carrier waves ( $f_{sc}$ frequencies) on Pin40 and Pin41.	0	3	5	mV <sub>P-P</sub>
R-Y		0	3	5	mV <sub>P-P</sub>
Residual Harmonics Level B-Y	Measure residual higher harmonics (double the $f_{sc}$ frequency) on Pin40 and Pin41.	0	20	30	mV <sub>P-P</sub>
R-Y		0	20	30	mV <sub>P-P</sub>
TINT Control TINT Maximum	Input NTSC rainbow signal. Measure TINT of data = 00H, 40H, and 7FH. TINT 0° is when the 6th bar of B-Y is maximum.	27	32	39	DEG
TINT Center		-12	-4	+8	DEG
TINT Minimum		-39	-44	-49	DEG
PAL/NTSC Color Difference Amplitude Adjustment Gain		-2	-1	-0.5	dB
Identification Output PAL	Measure output voltage from Pin39.	8.0	8.3	8.6	V
SECAM		4.3	4.6	4.9	V
NTSC		0.0	0.1	0.4	V
<b>Chroma Section 2 (SECAM)</b>					
Color System Identification Mode Switch Threshold Voltage	Measure voltager at Pin44 at which SECAM signal becomes unable to be demodulated when the DC voltage applied to TP44 is varied from 6V to 0V.	4.7	5.0	5.3	V
ACC Characteristics Input Id 150mV <sub>P-P</sub>	$V_{32} = 1V$ . Measure ident amplitude at Pin28	220	280	340	mV <sub>P-P</sub>
Input Id 50mV <sub>P-P</sub>		220	280	340	mV <sub>P-P</sub>
Killer-On Level Ident Data = 0	Input color bar signal. Measure burst amplitude at which color begins to disappear when burst is gradually reduced.	0.1	1.0	3.0	mV <sub>P-P</sub>
Ident Data = 1		0.1	1.0	3.0	mV <sub>P-P</sub>
B-Y Output Amplitude	Input color bar signal. Measure output amplitude at Pin41.	400	580	750	mV <sub>P-P</sub>
R-Y Output Amplitude	Input color bar signal. Measure output amplitude at Pin40.	450	680	950	mV <sub>P-P</sub>
BELL Monitor Switch Threshold Voltage		1.5	1.8	2.1	V
BELL Filter Characteristics Ident Ratio		0.9	1.0	1.1	
Cyan Bar		1.00	1.15	1.30	
Yellow Bar		1.10	1.25	1.40	

**AC Characteristics (Cont'd):**  $V_{CC} = 9V$ , Logic  $V_{CC} = 3.3V$ ,  $T_A = +25^\circ C$  unless otherwise specified)

Parameter	Test Conditions	Min	Typ	Max	Unit
<b>Chroma Section 2 (Cont'd) (SECAM)</b>					
BELL Filter $f_o$ Control Range	Data = 07	70	105	140	kHz
	Data = 00	-175	-140	-105	kHz
PLL Pull-In Range	High	4.75	5.0	5.5	MHz
	Low	3.0	3.7	3.9	MHz
Black Level Offset Voltage		-15	0	+15	mV
Black Level Offset Adjustment	Maximum	19	24	29	mV
	Minimum	-31	-28	-25	mV
SECAM Color Difference Amplitude Adjustment Gain		-1.0	-1.8	-2.5	dB
		-2.0	-1.0	-0.5	dB
		-0.5	0	+0.5	dB
		0.5	1.0	1.5	dB
<b>TEXT/Matrix Section</b>					
RGB Maximum Output	Measure maximum output voltage from Pin16 when WPL is OFF	7.3	7.7	8.8	V
Color Difference Input Dynamic Range	Measure input dynamic range at Pin37 and Pin38	1.6	2.0	2.3	$V_{P-P}$
Relative Amplitude	Input PAL rainbow signal. Measure G/B in the color difference output mode selected by bus on RGB output pins.	0.31	0.37	0.42	
Relative Phase	Input PAL rainbow signal. Measure $\theta(G) - \theta(B)$ in the color difference output mode selected by bus on RGB output pins.	230	237	245	DEG
Color Control Characteristics	Maximum Gain	18.0	19.5	21.0	dB
	Center Gain	-9	-7	-5	dB
	Minimum Gain	-80	-50	-40	dB
	Maximum Gain Voltage	3.2	3.5	3.8	V
	Minimum Gain Voltage	2.2	2.5	2.8	V
Contrast Control Characteristics	Maximum Gain	3.5	5.0	6.5	dB
	Minimum Gain	-16	-14	-12	dB
	Maximum Gain Voltage	2.2	2.5	2.8	V
	Minimum Gain Voltage	1.2	1.5	1.8	V
Brightness Control Characteristics	Maximum Voltage	3.2	3.5	3.8	V
	Center Voltage	1.8	2.0	2.2	V
	Minimum Voltage	0.2	0.5	0.8	V
	Control Voltage	Measure DC voltage at Pin18 during trace period when $V_{53} = 1V$ .	0.7	1.0	1.3
	Measure DC voltage at Pin18 during trace period when $V_{53} = 1V$ .	2.7	3.0	3.3	V
Brightness Tracking	Measure DC voltage difference between R, G, and B outputs of brightness data = 40H.	-0.2	0	+0.2	V
WPL Voltage	Measure maximum output voltage from Pin18 when WPL is ON.	5.7	6.0	6.3	V

**AC Characteristics (Cont'd):**  $V_{CC} = 9V$ , Logic  $V_{CC} = 3.3V$ ,  $T_A = +25^\circ C$  unless otherwise specified)

Parameter	Test Conditions	Min	Typ	Max	Unit
<b>TEXT/Matrix Section (Cont'd)</b>					
Blanking Output Voltage	Measure output voltage from Pin18 during blanking period.	0.3	0.5	0.8	V
Vertical Blanking Period 50Hz	Measure vertical blanking period width.	–	23	–	H
60Hz		–	18	–	H
Horizontal Blanking Threshold Voltage	Measure lowest voltage at Pin9 which causes horizontal blanking.	0.5	0.7	1.0	V
Horizontal Blanking Delay Time	Measure blanking–on delay time.	0.0	0.1	0.3	$\mu s$
	Measure blanking–off delay time.	0.1	0.3	0.5	$\mu s$
External Blanking Threshold Current	Measure minimum input current to Pin64 which causes blanking.	300	330	400	$\mu A$
Mute Output Voltage		1.7	2.0	2.3	V
Mute Switch Threshold Voltage		4.7	5.0	5.3	V
External TEXT Input Dynamic Range	Measure input dynamic range on Pin22, Pin23, and Pin24.	1.0	1.5	–	$V_{P-P}$
External TEXT Contrast Control Maximum Gain	Input signal 3 ( $V_{im} = 0.1V_{P-P}$ ) to TP24. Measure output amplitude at Pin18 when data = 7FH, 40H, and 00H as $V_{18}$ . Gain = $20\log(V_{18}/0.1)$ .	15	16	18	dB
Center Gain		12.0	13.5	15.0	dB
Minimum Gain		–7	–4	–2	dB
External TEXT Rising Time	Load capacitance is 10pF. Adjust contrast data so that RGB output amplitude is $1V_{P-P}$ .	10	25	50	ns
External TEXT Falling Time		10	25	50	ns
External TEXT Output Delay Time		10	25	50	ns
External TEXT Switching Delay Time		10	25	50	ns
TV/TEXT Switching Voltage		0.7	1.0	1.3	V
Crosstalk TV $\rightarrow$ TEXT		–45	–55	–	dB
TEXT $\rightarrow$ TV		–45	–55	–	dB
External TEXT Bandwidth		12	15	20	MHz
All White Mode Output Voltage R Output	Select all–white mode by bus. Measure R, G, and B amplitudes during trace period.	3.6	3.8	4.0	$V_{P-P}$
G Output		3.5	3.7	3.9	$V_{P-P}$
B Output		3.6	3.8	4.0	$V_{P-P}$
<b>Sync. Section</b>					
Horizontal Sync Separation Level		30	35	40	%
Sync Separation Input Sensitivity		10	18	25	$\mu A$
Horizontal Free Running Frequency	measure H.out frequency when no sync input and no FBP input.	15.50	15.62	15.75	kHz
AFC1 Pull–In Range High	Center frequency is $f_H = 15.625Hz$	500	750	1000	Hz
Low		–500	–750	–1000	Hz
Horizontal Oscillation Frequency Control Range		14.70	15.62	16.90	Hz
Horizontal Oscillation Frequency Control Sensitivity		2.0	2.3	2.6	kHz/V
AFC1 Detection Current		250	350	450	$\mu A$

**AC Characteristics (Cont'd):**  $V_{CC} = 9V$ , Logic  $V_{CC} = 3.3V$ ,  $T_A = +25^{\circ}C$  unless otherwise specified)

Parameter	Test Conditions	Min	Typ	Max	Unit
<b>Sync. Section (Cont'd)</b>					
AFC1 Stop Period 50Hz	Observe Pin2 to measure the period while AFC1 does not operate.	308 ~ 6			H
60Hz		258 ~ 6			H
Horizontal Oscillation Starting Voltage		3.5	4.0	4.5	V
Horizontal Output Starting Voltage		4.0	4.5	5.0	V
Horizontal Output Duty Cycle	Measure duty cycle = (High period) / (1H period) at Pin6	38	41	44	%
Horizontal Output Voltage High	Measure high voltage at Pin6	4.7	5.0	5.3	V
Low	Measure low voltage at Pin6	–	0	0.3	V
AFC2 Control Range		14	15	16	$\mu s$
Horizontal Phase Adjustment Range		$\pm 2.0$	$\pm 2.5$	$\pm 3.0$	$\mu s$
Vertical Free Running Frequency	Measure output frequency at Pin64 when no sync signal input.	–	50/60	–	Hz
Vertical Pull-In Range		240.5	–	352.0	H
Vertical 60Hz Identification Range		240.5	–	288.0	H
Vertical Pulse Output Voltage High	Measure high voltage at Pin64.	4.2	4.5	4.8	V
Low	Measure low voltage at Pin64	–	0	0.3	V
Vertical Blanking Pulse Output Voltage	Measure middle voltage at Pin64	2.7	3.0	3.3	V
Vertical Output Delay Time 50Hz		4.25	4.75	5.25	H
60Hz		0.25	0.75	1.25	H
Vertical Output Phase Variable Range	Sync input 60Hz, data = 000, 111	0	–	7	H
SCP Output Voltage Clamp Gate Pulse Period		7.3	7.5	7.8	V
Horizontal Blanking Period		4.2	4.5	4.8	V
Vertical Blanking Period		2.2	2.5	2.8	V
FBP Input Terminal Voltage High	Sink current into Pin9 is kept at 0.1mA when measured. Measure high and low voltages at Pin9.	1.1	1.5	1.8	V
Low		–	0	0.3	V
Gate Pulse Width		1.8	2.0	2.2	$\mu s$

### Pin Connection Diagram

Vertical Separation	<b>1</b>	<b>64</b>	V <sub>P</sub> Output
Horizontal AFC1	<b>2</b>	<b>63</b>	Sync Input
32f <sub>H</sub> VCO	<b>3</b>	<b>62</b>	Video GND
I <sup>2</sup> L V <sub>CC</sub>	<b>4</b>	<b>61</b>	Black Detection
Horizontal V <sub>CC</sub>	<b>5</b>	<b>60</b>	Video Input
Horizontal Output	<b>6</b>	<b>59</b>	Video V <sub>CC</sub>
R Clamp	<b>7</b>	<b>58</b>	APL1
Horizontal AFC2	<b>8</b>	<b>57</b>	APL2
FBP Input	<b>9</b>	<b>56</b>	Gamma Voltage
SCP Output	<b>10</b>	<b>55</b>	FAA
DAC Monitor	<b>11</b>	<b>54</b>	P/N ACC
I <sup>2</sup> L/Horizontal Out GND	<b>12</b>	<b>53</b>	ABL
SDA	<b>13</b>	<b>52</b>	Y Clamp
SCL	<b>14</b>	<b>51</b>	3.58 Chroma Input
GND	<b>15</b>	<b>50</b>	Chroma V <sub>CC</sub>
R Output	<b>16</b>	<b>49</b>	4.43 Chroma Input
G Output	<b>17</b>	<b>48</b>	B Clamp
B Output	<b>18</b>	<b>47</b>	PAL Ident
TEXT V <sub>CC</sub>	<b>19</b>	<b>46</b>	Chroma GND
G Clamp	<b>20</b>	<b>45</b>	3.58 X'tal
TV/TEXT	<b>21</b>	<b>44</b>	M/N X'tal
External R Input	<b>22</b>	<b>43</b>	4.43 X'tal
External G Input	<b>23</b>	<b>42</b>	NTSC Ident
External B Input	<b>24</b>	<b>41</b>	B-Y Output
ACL	<b>25</b>	<b>40</b>	R-Y Output
QIF InputAPC	<b>26</b>	<b>39</b>	P/N/S Identification Output
SECAM GND	<b>27</b>	<b>38</b>	B-Y Input
f <sub>sc</sub> Output	<b>28</b>	<b>37</b>	R-Y Input
SECAM f <sub>sc</sub>	<b>29</b>	<b>36</b>	SECAM V <sub>CC</sub>
B-Y De-Emphasis	<b>30</b>	<b>35</b>	SECAM Input
SECAM Ident	<b>31</b>	<b>34</b>	BELL f <sub>o</sub>
R-Y De-Emphasis	<b>32</b>	<b>33</b>	SECAM ACC

