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## **NTE7151** **Integrated Circuit** **I<sup>2</sup>C Bus Control NTSC 1-Chip Color TV IC**

### **Description:**

The NTE7151 is an integrated circuit in a 56-Lead DIP type package designed for use as a PIF, SIF, video, chroma and deflection circuit for NTSC color TVs. This device also provides audio/video switching and a text interface.

### **Features:**

#### **PIF Circuit**

- PLL Type IF Demodulation (Bus Alignment)
- Adjustment Free AFT Without Tank Coil
- RF AGC Output (Delay Point: Bus Alignment)
- Dual Time Constant Fast AGC

#### **Video Circuit**

- Black Stretcher
- DC Restoration Circuit
- D.L. Aperture Compensate Circuit (Bus Control)
- Internal Filter Auto-Adjust Circuit (F<sub>SC</sub> Link Type)
- Uni-Color Circuit (Bus Control)
- 3.58MHz Trap Filter Circuit (Bus ON/OFF)
- Y Delay Line Circuit

#### **Chroma Circuit**

- Color Control Circuit (Bus Control)
- Tint Control Circuit (Bus Control)
- B.P.F. / T.O.F. Circuit (Bus Select)
- Included ACC/Killer Filter

#### **SIF Circuit**

- Inter Carrier SIF System
- External Sound Select Switch (Bus Select)
- Attenuator Circuit (Bus Control)

#### **Text Circuit**

- Linear RGB Input
- Cut Off/Drive Adjustment (Bus Adjustment)
- RGB Primary Color Output

#### **Deflection Circuit**

- Adjustment Free Countdown System
- Sync. Separation Output
- X-Ray Protect Circuit
- Auto-Slicer Type High Performance Sync. Separation Circuit
- Horizontal and Vertical Position Adjustment (Bus Adjustment)
- Vertical Amplitude Adjustment (Bus Adjustment)
- Vertical Ramp Output
- Dual Time Constant AFC Circuit

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

Power Supply Voltage, $V_{CC}$ .....	12V
Power Dissipation, $P_{Dmax}$ .....	2.19W
Derate Above $25^\circ\text{C}$ .....	17.5mW/ $^\circ\text{C}$
Input Terminal Voltage, $V_{in}$ .....	GND-0.3V to $V_{CC}+0.3V$
Input Signal Amplitude, $e_{in}$ .....	$4V_{P-P}$
Operating Temperature Range, $T_{opr}$ .....	$-20^\circ$ to $+65^\circ\text{C}$
Storage Temperature Range, $T_{stg}$ .....	$-55^\circ$ to $+150^\circ\text{C}$

**Recommended Operating Conditions:**

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
PIF Power Supply Voltage	$V_{CCP}$		8.5	9.0	9.5	V
SIF Power Supply Voltage	$V_{CCS}$		8.5	9.0	9.5	V
V/C/D Power Supply Voltage	$V_{CCV}$		8.5	9.0	9.5	V
H. $V_{CC}$ Power Supply Voltage	H. $V_{CC}$		8.5	9.0	9.5	V
D. $V_{CC}$ Power Supply Voltage	D. $V_{CC}$		2.7	3.3	3.8	V
TV External Video Input Level	$V_{in37/39}$	Including Sync.	-	1.0	-	$V_{P-P}$
Standard Video Input Level	$V_{in43}$	Including Sync.	-	1.0	-	$V_{P-P}$
Standard Chroma Input Level	$V_{in45}$	At Burst Signal	-	286	-	m $V_{P-P}$
FBP Width	$T_{FBP}$	$V_{th} = 1.4V, V_{CC} = -1.4V$	10	12	-	$\mu\text{s}$
FBP Input Flow In Current	$I_{FBPmax}$		-	-	2	mA
PIF Output Load Resistor	$R_{OP}$		2.0	8.2	-	k $\Omega$
SIF Output Load Resistor	$R_{OS}$		1.0	8.2	-	k $\Omega$
RGB Output Load Resistor	$R_{ORGB}$		-	1.8	-	k $\Omega$
Horizontal Output Load Resistor	$R_{HOUT}$	maximum 10mA	330	800	-	$\Omega$
Vertical Output Load Resistor	$R_{VOUT}$		4.1	5.7	-	k $\Omega$
Sync.Separation Output Flow In Current	$I_{syncmax}$		-	-	1	mA

**DC Electrical Characteristics:** ( $V_{CC} = 9V, H. V_{CC} = 9V, T_A = +25^\circ\text{C}$  unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Sound Output (Pin1)	$V_1$		3.2	3.7	4.2	V
Sound Output (Pin2)	$V_2$		3.2	3.7	4.2	V
RF AGC (Pin3)	$V_3$		-	0.0	0.5	V
AGC Filter (Pin5)	$V_5$		7.0	7.5	8.0	V
PIF GND (Pin6)	GND		-	0.0	-	V
PIF Input (Pin7)	$V_7$		1.5	2.0	2.5	V
PIF Input (Pin8)	$V_8$		-	0.0	0.5	V
PIF $V_{CC}$ (Pin9)	$V_{CC}$		-	9.0	-	V
Loop Filter (Pin10)	$V_{10}$		-	4.5	-	V
APC Filter (Pin11)	$V_{11}$		6.0	6.5	7.0	V
VCXO (Pin12)	$V_{12}$		5.3	5.8	6.3	V
V/C/D GND (Pin13)	GND		-	0.0	-	V
F-BLK (Pin14)	$V_{14}$		-	0.0	-	V
Analog R Input (Pin15)	$V_{15}$		4.4	4.9	5.4	V
Analog G Input (Pin16)	$V_{16}$		4.4	4.9	5.4	V
Analog B Input (Pin17)	$V_{17}$		4.4	4.9	5.4	V

**DC Electrical Characteristics (Cont'd):** ( $V_{CC} = 9V$ , H.  $V_{CC} = 9V$ ,  $T_A = +25^\circ C$  unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
D. $V_{CC}$ (Pin18)	$V_{CC}$		–	3.3	–	V
R Output (Pin19)	$V_{19}$	BRT, C.O Cent	2.4	2.7	2.9	V
G Output (Pin20)	$V_{20}$	BRT, C.O Cent	2.4	2.7	2.9	V
B Output (Pin21)	$V_{21}$	BRT, C.O Cent	2.4	2.7	2.9	V
V SEPA (Pin25)	$V_{25}$		5.8	6.3	6.8	V
H. $V_{CC}$ (Pin26)	$V_{26}$		–	9.0	–	V
SCL (Pin27)	$V_{27}$		4.5	5.0	5.5	V
SDA (Pin28)	$V_{28}$		4.5	5.0	5.5	V
X–RAY (Pin29)	$V_{29}$		–	0.0	–	V
H. AFC (Pin33)	$V_{33}$		7.0	7.5	8.0	V
32f <sub>H</sub> VCO (Pin34)	$V_{34}$		5.5	6.0	6.5	V
D. GND (Pin35)	GND		–	0.0	–	V
ABL (Pin36)	$V_{36}$	BRT, COL Cent	2.9	3.4	3.9	V
TV Input (Pin37)	$V_{37}$		2.9	3.0	3.9	V
ACL (Pin38)	$V_{38}$	BRT, COL Cent	2.9	3.4	3.9	V
EXT. Video Input (Pin39)	$V_{39}$		1.1	1.6	2.1	V
Black DET (Pin40)	$V_{40}$		6.1	6.6	7.1	V
AV/SW Output (Pin41)	$V_{41}$		1.8	2.3	2.8	V
DC Rest (Pin42)	$V_{42}$		5.5	6.0	6.5	V
Y Input (Pin43)	$V_{43}$		4.0	4.5	5.0	V
AFT (Pin44)	$V_{44}$		2.0	2.5	3.0	V
Chroma Input (Pin45)	$V_{45}$		1.6	1.85	2.1	V
V / C / D $V_{CC}$ (Pin46)	$V_{46}$		–	9.0	–	V
TV DET. Output (Pin47)	$V_{47}$		4.7	5.2	5.7	V
SIF $V_{CC}$ (Pin48)	$V_{CC}$		–	9.0	–	V
SIF GND (Pin51)	GND		–	0.0	–	V
Limiter Input (Pin52)	$V_{52}$		–	0.0	0.5	V
Audio TV Input (Pin53)	$V_{53}$		2.5	3.0	3.5	V
De–Emphasis (Pin54)	$V_{54}$	Pin4 GND	4.0	4.5	5.0	V
EXT. Audio Input (Pin55)	$V_{55}$		2.5	3.0	3.5	V
EXT. Audio Input (Pin56)	$V_{55}$		2.5	3.0	3.5	V
<b>Current Consumption</b>						
IF Power Supply Current	$I_{cci}$		32.8	46.0	52.0	mA
V / C / D Power Supply Current	$I_{ccv}$		52.7	71.0	76.8	mA
H. $V_{CC}$ Power Supply Current	$I_{cch}$		10.7	14.0	18.4	mA
D. $V_{CC}$ Power Supply Current	$I_{ccd}$		5.2	10.0	11.6	mA

**AC Electrical Characteristics:** ( $V_{CC} = 9V$ , H.  $V_{CC} = 9V$ ,  $T_A = +25^\circ C$  unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>PIF</b>						
Video Detected Output Level	$V_{O1}$		1.7	2.0	2.3	$V_{P-P}$
	$V_{O2}$		2.0	2.5	3.0	$V_{P-P}$
Input Sensitivity	$V_{INmin}$		–	42	–	$dB\mu V$
	$V_{INmax}$		100	107	–	$dB\mu V$
Sync Tip Level	$V_{SYNC}$		2.6	2.9	3.2	V
Output Level for No Input	$V_{IF}$		4.8	5.2	5.6	V
Differential Gain	DG		–	2	5	%
Differential Phase	DP		–	2	5	DEG
PIF Output Frequency Characteristics	$f_c$		5	7	–	MHz
Carrier Wave Compression Ratio	CR		50	55	–	dB
2 <sup>nd</sup> Harmonics Compression Ratio	HR		50	55	–	dB
PIF Input Resistance	$R_{iPIF}$		–	1.5	–	$k\Omega$
PIF Input Capacitance	$C_{iPIF}$		–	3.8	–	pF
Signal to Noise Ratio	S/N		52	55	–	dB
920kHz Beat	$I_{9200}$		42	45	–	dB
IF AGC Range	$RW_{AGC}$		61	65	69	dB
IF AGC Voltage	$V_{5MEAN}$		4.2	4.5	4.8	V
	$V_{5max}$		7.4	7.6	–	V
	$V_{5min}$		–	3.8	–	V
RF AGC Voltage	$V_{3max}$		7.7	8.2	–	V
	$V_{3min}$		–	0.0	0.5	V
RF AGC Control Range	$\Delta G_{RFAGC}$		35	40	–	dB
AFT Center Voltage	$V_{4CENT}$		2.2	2.5	2.8	V
AFT Voltage	$V_{4max}$		4.4	4.8	–	V
	$V_{4min}$		–	0.2	0.5	V
AFT Sensitivity	$\mu AFT$		–	40	–	$kHz/V$
AFT Output Resistance	$R_{AFTOUT}$		40	50	60	$k\Omega$
PIF VCO Control Sensitivity	$\beta_{FVCO}$		2.0	2.5	–	$MHz/V$
PIF VCO Pull-In Range	$f_{ph}$		1.0	1.5	–	MHz
	$f_{pl}$		1.0	1.5	–	MHz
PIF VCO Control Range	$\Delta f_{PIFVCO}$		–	4.4	–	MHz
<b>SIF</b>						
Sound Output Level	$V_{AAC}$		400	500	600	$mV_{rms}$
	$V_{ADC}$		–	4.5	–	V
Sound Distortion	$V_{AUDIO}$		–	0.3	1.0	%
AMR	AMR		50	60	–	dB
Limiting Sensitivity	$V_{LIM}$		–	35	–	$dB\mu V$
Sound Output Frequency Characteristics	$f_{AUDIOH}$		–	130	–	$kHz$
	$f_{AUDIO L}$		–	–130	–	$kHz$
Sound Output Resistance	$R_{SOUT}$		24	30	36	$k\Omega$

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

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>ATT</b>						
ATT Gain	$G_{ATTMAXE}$		-2.0	0.0	+2.0	dB
	$G_{ATTMAXT}$		4.0	6.0	8.0	dB
	$G_{ATTMEAN}$		-16	-12	-9	dB
	$G_{ATTMIN}$		-99	-85	-	dB
DC Voltage Drift	$V_{1VAR}$		-	-	50	mV
	$V_{1DC}$		3.2	3.7	4.2	V
Input Impedance	$R_{i53}$		-	30	-	k $\Omega$
	$R_{i55}$		-	47	-	k $\Omega$
Balance Characteristics	$B_{MAX}$		45	58	70	dB
	$B_{MIN}$		-70	-58	-45	dB
<b>Video</b>						
Input Impedance	$R_{i41}$		100	-	-	k $\Omega$
Input Dynamic Range	$V_{di41}$		1.0	1.2	1.5	V
Video Total Gain	$G_Y$		4.5	5.0	-	
Video Frequency Characteristic	$f_Y$		6.0	7.0	-	MHz
Maximum Output	$V_{do1}$		7.5	8.0	-	V
Black Expansion Amp Gain	$G_{BAMP}$		1.18	1.43	1.68	
Black Expansion Start Point	$G_{BSTP}$		40	50	60	IRE
DC Restoration	$T_{DC}$		100	103	105	%
Sharpness Control Characteristics	$G_{SHcent}$		1	4	7	dB
	$G_{SHmax}$		9	12	15	dB
	$G_{SHmin}$		-	-18	-15	dB
Sharpness Delay Time	$t_{SHDLY}$		-	125	-	ns
Contrast Control Characteristics	$G_{CNcent}$		4.5	6.0	7.5	dB
	$G_{CNmin}$		22.5	24.0	28.5	dB
H. V-BLK Output Voltage	$V_{BLK}$		-	0.7	1.0	V
V-BLK Width	$T_{VBLK}$		3.5 to 24.0			H
$f_{sc}$ Trap Gain	$G_{TRAP}$		-	-28	-20	dB
<b>OSD</b>						
OSD Switching Voltage	$V_{thOSD}$		0.7	1.0	1.3	V
OSD Delay Time	$t_{OSDDL Y}$		-	15	30	ns
OSD Delay Time Difference	$t_{OSDD}$		-	5	10	ns
OSD Rising Time	$\tau_R$		-	15	30	ns
OSD Falling Time	$\tau_F$		-	15	30	ns
Input Clamp Voltage	$V_{OSDC}$		4.4	4.9	5.4	V
OSD Gain	$G_{OSD}$		1.8	2.0	2.2	
Input Dynamic Range	$V_{diOSD}$		2.0	2.2	2.4	V
<b>Cutoff Drive</b>						
Brightness Control Characteristics	$V_{BRTmax}$		3.6	4.0	4.3	V
	$V_{BRTcen}$		2.4	2.7	3.0	V
	$V_{BRTmin}$		1.0	1.4	1.7	V

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

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>Cutoff Drive (Cont'd)</b>						
Brightness Control Difference Between 3 Axes	$\Delta V_{RGB}$		-50	0	+50	mV
Cutoff Control Characteristics	$V_{cutmax}$		0.5	0.65	0.8	V
	$V_{cutcen}$		-	0.0	-	V
	$V_{cutmin}$		-0.8	-0.65	-0.5	V
Drive Control Characteristics	$G_{drvmax}$		3.75	4.25	4.75	dB
	$G_{drvmin}$		-4.0	-3.5	-3.0	dB
<b>Chroma</b>						
Input Dynamic Range	$V_{di45}$		0.95	1.5	1.7	V
ACC Characteristics	$e_a$		-23	-20	-17	dB
	$e_b$		3	6	9	dB
	A		0.9	1.0	1.1	
Killer Point	EK		-48	-46	-43	dB
VCXO Frequency Control Range	$\Delta f_{VCXO}$		$\pm 500$	$\pm 600$	-	Hz
VCXO Frequency Control Sensitivity	$\beta_{VCXO}$		-	1.0	-	Hz/mV
VCXO Pull-In Range	$f_{VCXOPL}$		$\pm 300$	$\pm 450$	-	Hz
Demodulate Relative Gain	R/B		0.78	0.83	0.88	
	G/B		0.31	0.35	0.39	
Demodulate Relative Phase	R-B		84	91	98	DEG
	G-B		233	240	247	DEG
Carrier Wave Remain	$E_{CR}$		-	20	40	mV <sub>P-P</sub>
	$E_{CB}$		-	20	40	mV <sub>P-P</sub>
	$E_{CG}$		-	20	40	mV <sub>P-P</sub>
Color Control Characteristics	$V_{CLRmax}$		3.9	4.1	4.3	V <sub>P-P</sub>
	$G_{CLRcen}$		4.5	6.0	7.5	dB
	$G_{CLRmin}$		38	40	-	dB
Uni-Color Control Characteristics	$G_{UNIcen}$		4.5	6.0	7.5	dB
	$G_{UNImin}$		22	24	26	dB
Tint Control Characteristics	$\theta_{TNTcen}$		-7	0	+7	DEG
	$\Delta \theta_{TNT}$		$\pm 35$	$\pm 45$	$\pm 55$	DEG
Video Chroma Delay Time	$t_{V-C}$		-30	0	+30	ns
<b>Deflection</b>						
Horizontal Free Running Frequency	$f_H$		-100	0	+100	Hz
H. Out Pulse Duty	$T_H$		38	41	44	%
H. Out Voltage	$V_{HL}$		-	0.2	0.3	V
	$V_{HH}$		2.5	3.0	3.5	V
VCO OSC Start Voltage	$V_{OSCmin}$		3.0	3.5	4.0	V
H. Out Start Voltage	$V_{HST}$		3.7	4.0	-	V
H. Frequency Control Range	$\Delta f_H$		$\pm 500$	$\pm 650$	-	Hz
H. Frequency Control Sensitivity	$\beta_H$		-	500	-	Hz/V
H. Sync Pull-In Range	$\Delta f_{HPUL}$		$\pm 450$	$\pm 500$	-	Hz
H. Pull-In Stop Period	$T_{HSTP}$		259 to 272			H

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

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>Deflection (Cont'd)</b>						
AFC-2 Control Range	$T_{AFC2}$		16	17	–	$\mu s$
Horizontal Position Adjustment	$T_{PAFC2}$		–	$\pm 3$	–	$\mu s$
X-Ray Protection Detection Voltage	$V_{XDET}$		3.35	3.5	3.65	V
X-Ray Protection Hold Voltage	$V_{XHLD}$		3.9	4.2	4.5	V
X-Ray Protection Hold Current	$V_{XLD}$		80	100	120	$\mu A$
Vertical Free Running Frequency	$f_V$		–	295	–	H
V. Sync Pull-In Range	$T_{VST}$		–	224	–	H
	$T_{VEND}$		–	295	–	H
V. Out Pulse Width	$T_V$		–	8	–	H
V. Ramp Amplitude Control	$V_{VL}$		2.2	2.4	–	V
	$V_{VH}$		–	1.6	1.8	V
H. Sync Separation Level	$R_{sepa}$		30	35	40	%
Forced V. OSC (262.5H)	$f_{V60}$		–	60	–	Hz

**Pin Connection Diagram**

Sound Output	<b>1</b>	<b>56</b>	Ext. Audio
Sound Output	<b>2</b>	<b>55</b>	Ext. Audio
RF AGC	<b>3</b>	<b>54</b>	De-Emphasis
SIF Tank	<b>4</b>	<b>53</b>	Audio TV Input
AGC Filter	<b>5</b>	<b>52</b>	Limiter Input
PIF GND	<b>6</b>	<b>51</b>	SIF GND
PIF Input	<b>7</b>	<b>50</b>	PIF Tank
PIF Input	<b>8</b>	<b>49</b>	PIF Tank
PIF $V_{CC}$	<b>9</b>	<b>48</b>	SIF $V_{CC}$
Loop Filter	<b>10</b>	<b>47</b>	TV Det. Output
APC Filter	<b>11</b>	<b>46</b>	$V_{CC}$
VCXO	<b>12</b>	<b>45</b>	Chroma Input
GND	<b>13</b>	<b>44</b>	AFT
F-BLK	<b>14</b>	<b>43</b>	Y Input
Analog R Input	<b>15</b>	<b>42</b>	DC Restoration
Analog G Input	<b>16</b>	<b>41</b>	AV/SW Output
Analog B Input	<b>17</b>	<b>40</b>	Black Det
D. $V_{CC}$	<b>18</b>	<b>39</b>	Ext. Video
R Output	<b>19</b>	<b>38</b>	ACL
G Output	<b>20</b>	<b>37</b>	TV Input
B Output	<b>21</b>	<b>36</b>	ABL
V. Output	<b>22</b>	<b>35</b>	D. GND
NFB	<b>23</b>	<b>34</b>	$32f_H$ VCO
V. Ramp	<b>24</b>	<b>33</b>	H. AFC
V Sepa Filter	<b>25</b>	<b>32</b>	H. Output
H. $V_{CC}$	<b>26</b>	<b>31</b>	Sync Output
SCL	<b>27</b>	<b>30</b>	FBP Input
SDA	<b>28</b>	<b>29</b>	X-Ray

