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NTE7151 **Integrated Circuit** **I²C 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_{SC} 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°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° to $+65^\circ\text{C}$
Storage Temperature Range, T_{stg}	-55° 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	-	μs
FBP Input Flow In Current	I_{FBPmax}		-	-	2	mA
PIF Output Load Resistor	R_{OP}		2.0	8.2	-	k Ω
SIF Output Load Resistor	R_{OS}		1.0	8.2	-	k Ω
RGB Output Load Resistor	R_{ORGB}		-	1.8	-	k Ω
Horizontal Output Load Resistor	R_{HOUT}	maximum 10mA	330	800	-	Ω
Vertical Output Load Resistor	R_{VOUT}		4.1	5.7	-	k Ω
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 _H 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
Current Consumption						
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
PIF						
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 nd 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	ΔG_{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	μAFT		–	40	–	kHz/V
AFT Output Resistance	R_{AFTOUT}		40	50	60	$k\Omega$
PIF VCO Control Sensitivity	β_{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	Δf_{PIFVCO}		–	4.4	–	MHz
SIF						
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
ATT						
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 Ω
	R_{i55}		-	47	-	k Ω
Balance Characteristics	B_{MAX}		45	58	70	dB
	B_{MIN}		-70	-58	-45	dB
Video						
Input Impedance	R_{i41}		100	-	-	k Ω
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
OSD						
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	τ_R		-	15	30	ns
OSD Falling Time	τ_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
Cutoff Drive						
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
Cutoff Drive (Cont'd)						
Brightness Control Difference Between 3 Axes	ΔV_{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
Chroma						
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	Δf_{VCXO}		± 500	± 600	-	Hz
VCXO Frequency Control Sensitivity	β_{VCXO}		-	1.0	-	Hz/mV
VCXO Pull-In Range	f_{VCXOPL}		± 300	± 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 _{P-P}
	E_{CB}		-	20	40	mV _{P-P}
	E_{CG}		-	20	40	mV _{P-P}
Color Control Characteristics	V_{CLRmax}		3.9	4.1	4.3	V _{P-P}
	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	θ_{TNTcen}		-7	0	+7	DEG
	$\Delta \theta_{TNT}$		± 35	± 45	± 55	DEG
Video Chroma Delay Time	t_{V-C}		-30	0	+30	ns
Deflection						
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	Δf_H		± 500	± 650	-	Hz
H. Frequency Control Sensitivity	β_H		-	500	-	Hz/V
H. Sync Pull-In Range	Δf_{HPUL}		± 450	± 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
Deflection (Cont'd)						
AFC-2 Control Range	T_{AFC2}		16	17	–	μs
Horizontal Position Adjustment	T_{PAFC2}		–	± 3	–	μs
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	μA
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	1	56	Ext. Audio
Sound Output	2	55	Ext. Audio
RF AGC	3	54	De-Emphasis
SIF Tank	4	53	Audio TV Input
AGC Filter	5	52	Limiter Input
PIF GND	6	51	SIF GND
PIF Input	7	50	PIF Tank
PIF Input	8	49	PIF Tank
PIF V_{CC}	9	48	SIF V_{CC}
Loop Filter	10	47	TV Det. Output
APC Filter	11	46	V_{CC}
VCXO	12	45	Chroma Input
GND	13	44	AFT
F-BLK	14	43	Y Input
Analog R Input	15	42	DC Restoration
Analog G Input	16	41	AV/SW Output
Analog B Input	17	40	Black Det
D. V_{CC}	18	39	Ext. Video
R Output	19	38	ACL
G Output	20	37	TV Input
B Output	21	36	ABL
V. Output	22	35	D. GND
NFB	23	34	32f _H VCO
V. Ramp	24	33	H. AFC
V Sepa Filter	25	32	H. Output
H. V_{CC}	26	31	Sync Output
SCL	27	30	FBP Input
SDA	28	29	X-Ray

