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NTE7116
Integrated Circuit
Phase Lock Loop (PLL) Stereo Decoder
(BTSC System)

Description:

The NTE7116 is a phase lock loop (PLL) stereo decoder in a 20–Lead DIP type package designed primarily for low cost stereo decoding in a low–to–medium–line TV. The MUX input (Pin1) is a low impedance current input, the gain of the input amplifier is therefore determined by the external resistor R1. All characteristics are measured with R1 = 47kΩ. The de–emphasis of (L, R) and (L – R) can be chosen by means of external capacitors and resistors. The supply voltage range of the device is from 7V to 16V.

Features:

- Wide Supply Voltage Range
- Automatic Mono/Stereo Switching (Pilot Presence Detector)
- LED Driver for Stereo Indicator
- Smooth Mono/Stereo Control
- Matrix and Two Amplifiers for Left and Right Output Signals
- A Source Selector to Switch between the MUX Signal and an External Signal
- Mute Circuit for 60dB Muting of the Output Level
- External De–Emphasis Control of (L, R) and (L – R)
- 6dB Fixed Attenuation of (L – R) with respect to (L + R) Prior to Matrix
- All Pins are Protected Against Electrostatic Discharge (ESD)

Absolute Maximum Ratings:

Supply Voltage Range (Pin5), V_P 18V
LED Driver Current (Peak Value), I_3 . . . . . 75mA
Total Power Dissipation (T_A = +25°C), P_{tot} 1.9W
Electrostatic Handling, V_{es} . . . . . –2 to +2kV
Operating Ambient Temperature Range, T_A . . . . . 0° to +70°C
Storage Temperature Range, T_{stg} . . . . . –65° to +150°C

DC Characteristics: (V_S = 8.5V, T_A = +25°C, all voltages are with respect to GND (Pin20), all currents are positive into the device unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Supply Voltage	V_S		7.0	8.5	16.0	V
Total Current Consumption	I_{tot}	Without LED Driver	–	19	25	mA
Power Dissipation	P_{tot}		–	160	–	mW
Voltage Pin1	V_1		–	2.1	–	V
Pins 8, 9, 10, 11, 12, & 13	$V_{8–13}$		–	4.2	–	V
DC Output Current (Pin14 & Pin15)	$–I_{14}$, I_{15}		1.1	1.4	1.8	mA
LED Driver Current (Pin3)	I_3		–	–	20	mA
Switch “VCO–OFF” Voltage	V_{19}	I_{19} = 50µA	–	2	–	V
Switch “VCO–OFF” Current	I_{19}		50	–	–	µA

AC Characteristics: (V_S = 8.5V, T_A = +25°C, AC Conditions: (1) Input signal (V_i) of 815m$V_{P–P}$ for L = 1, R = 1 (mono), f_m = 1kHz (80% modulation); (2) MUX input signal (V_i) of 1.2$V_{P–P}$ for L = 1, R = 0 and no dbx, f_m = 1kHz (stereo) and V_{pilot} = 200$V_{P–P}$; (3) S1 open, unless specified (without L – R filter), VCO measured with an external IF roll–off network (–2dB at 31.5kHz = 2f_H) at the input. All the above conditions apply unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Overall Performance V_i to V_o						
Input Current (rms)	$I_{(rms)}$		–	–	12	µA
Overall gain	G_O	Mono; R1 = 47kΩ	4.0	5.8	7.0	dB
AF Output Voltage (rms)	$V_{11} = V_{10}$		460	560	640	mV
	$V_{15} = V_{14}$		–	245	–	mV
Total Harmonic Distortion	THD	Note 1	–	0.3	0.5	%
Output Voltage	$V_{11} = V_{10}$	THD = 1%	–	800	–	mV
Output Channel Unbalance	V_{11}/V_{10}		–	0.1	1.0	dB
Channel Separation	α	L = 1, R = 0	24	28	–	dB
Signal to Noise Ratio	S/N	Bandwidth 20Hz to 16kHz	–	76	–	dB
Pilot Presence Detector (Note 2)						
Switching to Stereo	V_{pilot}		–	40	60	mV
Mono			15	30	–	mV
Hysteresis	ΔV_{pilot}		–	2.5	–	dB
Channel Separation Full Stereo	α	$V_{16} \geq 1.25V$	24	28	–	dB
Smooth Operation		V_{16} = 1V Typ	–	10	–	dB
Attenuation (L – R)			–	6	–	dB

Note 1. Guaranteed for mono, mono + pilot and stereo.

Note 2. Adjustable.

AC Characteristics (Cont'd): (V_S = 8.5V, T_A = +25°C, AC Conditions: (1) Input signal (V_i) of 815mV_{P-P} for L = 1, R = 1 (mono), f_m = 1kHz (80% modulation); (2) MUX input signal (V_i) of 1.2V_{P-P} for L = 1, R = 0 and no dbx, f_m = 1kHz (stereo) and V_{pilot} = 200V_{P-P}; (3) S1 open, unless specified (without L – R filter), VCO measured with an external IF roll–off network (–2dB at 31.5kHz = 2f_H) at the input. All the above conditions apply unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Carrier & Harmonic Suppression at the Output (Note 3)						
Pilot Signal Suppression	αf_H	f_{pilot} = 15.734kHz (1f_H)	32	36	–	dB
Subcarrier Suppression	$\alpha 2f_H$	f = 2f_H	–	60	–	dB
VCO Suppression	$\alpha 12f_H$	f = 12f_H	–	75	–	dB
SAP Signal Suppression (Second Audio Program)	$\alpha 5f_H$	f = 5f_H	–	60	–	dB
Intermodulation Suppression f_m = 8.367kHz	α_2	Spurious Signal, f_s = 1kHz	–	80	–	dB
f_m = 10.832kHz	α_3	Spurious Signal, f_s = 1kHz	–	70	–	dB
Ripple Rejection	RR_{120}	f = 120Hz, V_{ripple} = 100mV, mono	–	50	–	dB
Voltage Controlled Oscillator (VCO)						
R Adjust (R5)	R_{adj}	f_{OSC} = 188.808kHz, R7 = 10kΩ 5%, C6 = 820pF 1%	0	–	8	kΩ
Capture Range	Δf/f	Deviation from f_{OSC} center frequency: V_{pilot} = 200mV_{P-P}	–	45	–	%
Temperature Coefficient	TC	Uncompensated	–	250 x 10^{-6}	–	K^{-1}
Output Amplifiers						
Gain MUX	G_V		6.7	7.2	7.7	dB
External Signal			–0.5	0	+0.5	dB
Input Impedance	Z_i		–	50	–	kΩ
Output Impedance	Z_o		–	10	–	Ω
External Load Impedance	Z_1		10	–	–	kΩ
External Load Capacitance	Z_1		–	–	1.5	nF
Mute Suppression MUX Signal	α		56	60	–	dB
External Signal			56	60	–	dB
DC Offset Voltage at Outputs	ΔV	Mute OFF–to–ON	–	10	50	mV
		Mute ON–to–OFF	–	10	50	mV
Source Selector (Pin6)						
Suppression of MUX Signal	α	$V_6 \geq 2V$	80	90	–	dB
Suppression of External Signal	α	$V_6 \leq 0.8V$	56	60	–	dB
Switching Level (MUX Selected) Voltage	V_{IL}		–	–	0.8	V
Current	I_{IL}	V_i = 0.8V	–	10	25	μA

Note 3. S1 closed; reference: AF output voltage f = 1kHz mono.

AC Characteristics (Cont'd): (V_S = 8.5V, T_A = +25°C, AC Conditions: (1) Input signal (V_i) of 815mV_{P-P} for L = 1, R = 1 (mono), f_m = 1kHz (80% modulation); (2) MUX input signal (V_i) of 1.2V_{P-P} for L = 1, R = 0 and no dbx, f_m = 1kHz (stereo) and V_{pilot} = 200V_{P-P}; (3) S1 open, unless specified (without L – R filter), VCO measured with an external IF roll–off network (–2dB at 31.5kHz = 2f_H) at the input. All the above conditions apply unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Source Selector (Cont'd) (Pin6)						
Switching Level (External Selected) Voltage	V_{IH}		2	–	V_P	V
Current	I_{IH}	$V_i = V_P$	–	0.1	1.0	µA
Muting Circuit (Pin7)						
Input Voltage	V_{IL}	Mute ON	–	–	0.8	V
	V_{IH}	Mute OFF	2	–	V_P	V
Input Current	$-I_{IL}$	Mute ON, V_{IL} = 0.8V	–	10	25	µA
	I_{IL}	Mute OFF, $V_{IH} = V_P$	–	0.1	1.0	µA

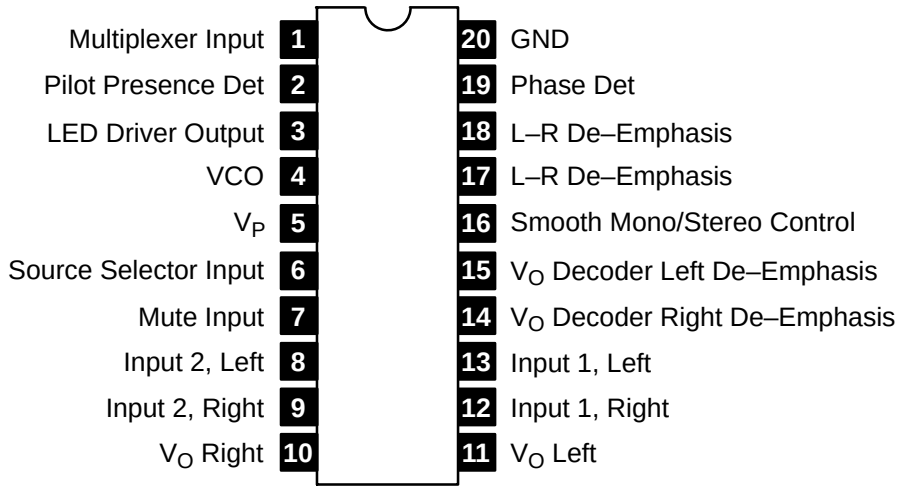
Note 4. Intermodulation suppression (Beat Frequency Components (BFC)):

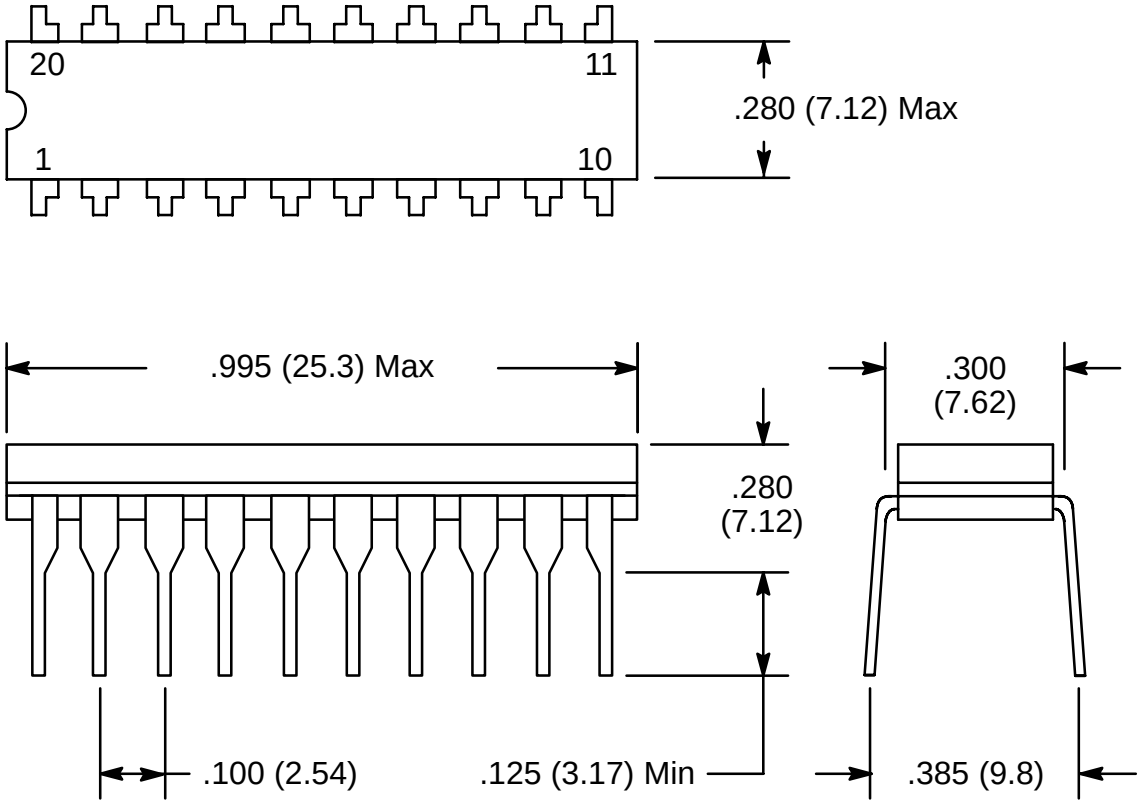
$$\alpha_2 = \frac{V_O \text{ (signal) (at 1kHz)}}{V_O \text{ (spurious) (at 1kHz)}} \quad ; \quad f_s = (2 \times 8.367\text{kHz}) - f_H$$

$$\alpha_3 = \frac{V_O \text{ (signal) (at 1kHz)}}{V_O \text{ (spurious) (at 1kHz)}} \quad ; \quad f_s = (3 \times 10.823\text{kHz}) - 2f_H$$

measured with 100% modulated input signal: L = R; pilot signal = 200mV_{P-P}; f_m = 8.367 or 10.823kHz.

Pin Connection Diagram




20
11
1
10
.280 (7.12) Max
.995 (25.3) Max
.300
(7.62)
.280
(7.12)
.100 (2.54)
.125 (3.17) Min
.385 (9.8)