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NTE7050
Integrated Circuit
Phase Lock Loop (PLL) Stereo Decoder

Description:

The NTE7050 is a Phase Lock Loop (PLL) stereo decoder with cassette head amplifiers in a 16–Lead DIP type package designed especially for car radios. This device has SDS circuitry where fluctuating signal strength can cause demodulation noise and distortion. The stereo decoder is compensated for a typical IF filter with a roll–off frequency of 50kHz (2dB down at 38kHz).

Features:

- A Voltage–Controlled Oscillator
- A Pilot Presence Detector and an Automatic Mono/Stereo Switch
- A Matrix and Two Amplifiers for the Left and Right Output Signal
- Two Output Buffers with 10dB Gain and Low Output Impedance
- Mute Circuit
- A Source Selector for Radio or Cassette
- An Input Amplifier of which the Gain can be Adjusted by means of an External Input Resistor
- A Pilot Cancelling Circuit for an Extra Suppression of the Pilot Signal of 15dB
- An Signal Dependent Stereo (SDS) Circuit for a Smooth Change Over from Stereo to Mono at Weak Tuner Input Signals

Absolute Maximum Ratings:

Supply Voltage (Pin3 and Pin9), $V_{3–5}$, $V_{9–5}$ 18V
LED Driver (Peak Current), I_3 . . . . 75mA
Total Power Dissipation (T_A = +25°C), P_{TOT} 1.6W
Operating Ambient Temperature Range, T_A . . . . –30° to +80°C
Storage Temperature Range, T_{stg} . . . . –55° to +150°C
Thermal Resistance, Junction–to–Ambient, R_{thJA} . . . . 75°C/W

Recommended Operating Characteristics: (All voltages with reference to Pin5)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Operating Supply Voltage	V_{CC}		7.0	8.5	16.0	V

DC Electrical Characteristics: (V_{CC} = 8.5V, T_A = +25°C unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Current Consumption (Without LED Driver)	I_{TOT}		–	15	–	mA
Power Dissipation	P_D		–	125	–	mW
Voltages on Pin15	$V_{15–5}$		–	2.0	–	V
Voltages on Pin16, Pin12	$V_{16–5}$, $V_{12–5}$		–	3.5	–	V
DC Current Pin14	$–I_{14}$		195	275	390	μA
DC Current Pin2	$–I_2$		195	275	390	μA
Output Current Pin3	$–I_3$		–	–	20	mA
Switch "VCO OFF" Voltage (Pin7)	V_7		–	2.2	–	V
Current (Pin7)	I_7		–	–	50	μA

AF Conditions:

Input MUX signal is $1V_{P–P}$ = 1kHz; V_{PILOT} = 32mV (9%), oscillator adjusted to f_{OSC} = 228kHz at V_I = 0V, unless otherwise specified. (All figures are measured with a roll–off network of 50kHz (2dB down at 38kHz) at the input.

AC Electrical Characteristics: (All parameters are measured in the circuit at nominal supply voltage(V_{CC} = 8.5V) and T_A = +25°C)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Gain Input Amplifier	A_V		–	–	20	dB
Input Impedance (External)	Z_I		–	47	–	kΩ
Maximum Input Voltage	V_I		–	–	TBD	$V_{P–P}$
Gain Output Buffers	A_V		–	10	–	dB
Maximum Output Voltage	V_O12, 16	THD ≤ 1%	–	–	TBD	V_0
Output Impedance	Z_O	Pin12, Pin16	–	–	500	Ω
Maximim Load Impedance	Z_L		5.0	–	–	kΩ
Muting Level	α muting		–	90	–	dB
Source Selector	α		–	90	–	dB
Overall Performance						
Overall Gain (Mono)	V_{OUT}/V_{IN}		10	11	12	dB
AF Output Voltage (RMS) Mono	V12 = V16		1.1	1.25	–	V
Total Harmonic Distortion	THD	V_{OUT} = $1.2V_{RMS}$, Note 1	–	–	0.5	%
Output Voltage	V_{OUT} 12, 16	THD = 1%	–	–	TBD	V
Output Channel Unbalance	$\frac{V_{OUT}\ 12}{V_{OUT}\ 16}$		–	0.2	1.0	dB
Channel Separation	α	L = 1, R = 0	26	40	–	dB
Signal–to–Noise Ratio	S/N	Bandwidth 20Hz to 16kHz	–	76	–	dB
		Bandwidth DINA	–	82	–	dB

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

AC Electrical Characteristics (Cont'd): (All parameters are measured in the circuit at nominal supply voltage(V_{CC} = 8.5V) and T_A = +25°C)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
SDS Control						
10dB Channel Separation	V4		–	1.0	–	V
Full Stereo	V4	Channel Separation ≥ 26dB	–	1.2	–	V
Full Mono	V4	Channel Separation ≥ 1dB	–	0.8	–	V
Stereo/Mono Switch (R6 – 5 = 180k, Note 2)						
For Switching to Stereo	V_I		–	14	20	mV
For Switching to Mono	V_I		4	–	–	mV
Hysteresis	ΔV_I		–	4	–	mV
Carrier and Harmonic Suppression at the Output (Note 3)						
Pilot Signal	α19	f = 19kHz, R6–5 = 180kΩ, Note 2	32	40	–	dB
Subcarrier	α38	f = 38kHz	–	45	–	dB
	α57	f = 57kHz	–	50	–	dB
	α228	f = 228kHz	–	75	–	dB
Intermodulation	α2	f_M = 10kHz, spurious signal, f_S = 1kHz, Note 4	–	50	–	dB
	α3	f_M = 13kHz, spurious signal, f_S = 1kHz, Note 4	–	50	–	dB
Traffic Radio (VWF) Suppression	α57 (VWF)	f = 57kHz, Note 5	–	80	–	dB
SCA (Subsidary Communications Authorization)	α67	f = 67kHz, Note 6	–	70	–	dB

Note 2. Also adjustable.

Note 3. Reference output voltage at 1kHz (measured channel R (Pin2)).

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

$$\alpha 2 = \frac{V_O \text{ (signal) at 1kHz}}{V_O \text{ (spurious) at 1kHz}} \; : \; f_S = (2 \times 10\text{kHz}) - 19\text{kHz}$$

$$\alpha 3 = \frac{V_O \text{ (signal) at 1kHz}}{V_O \text{ (spurious) at 1kHz}} \; : \; f_S = (3 \times 13\text{kHz}) - 38\text{kHz}$$

measured with: 91% mono signal; f_M = 10 or 13kHz; 9% pilot signal.

Note 5. Traffic ratio (VWF) suppression:

$$\alpha 57 \text{ (VWF)} = \frac{V_O \text{ (signal) at 1kHz}}{V_O \text{ (spurious) at 1kHz} \pm 23\text{Hz}}$$

measured with: 91% stereo signal; f_M = 1kHz; 9% pilot signal; 5% traffic subcarrier (f = 57kHz; 60% AM modulated with f mod. 23Hz).

Note 6. SCA (Subsidary Communications Authorization):

$$\alpha 67 = \frac{V_O \text{ (signal) at 1kHz}}{V_O \text{ (spurious) at 9kHz}} \; f_S = (2 \times 38\text{kHz}) - 67\text{kHz}$$

measured with: 81% mono signal; f_M = 1kHz; 9% pilot signal; 10% SCA–subcarrier (f_S = 67kHz, unmodulated).

AC Electrical Characteristics (Cont'd): (All parameters are measured in the circuit at nominal supply voltage(V_{CC} = 8.5V) and T_A = +25°C)

Parameter	Symbol	Test Conditions		Min	Typ	Max	Unit
Carrier and Harmonic Suppression at the Output (Cont'd) (Note 3)							
ACI (Adjacent Channel Interference)	α114	f = 114kHz, Note 7		–	90	–	dB
	α190	f = 190kHz, Note 7		–	60	–	dB
Ripple Rejection	RR100	f = 100Hz, V_{RIPPLE} = 100mV	V9 = 8.5V	–	46	–	dB
			V9 = 7.0V	–	TBD	–	dB
VCO (Voltage–Controlled Oscillator)							
Oscillator Frequency Adjustable with R8	f_{OSC}			–	228	–	kHz
Capture Range (Deviation from 228kHz Center Frequency)	Δf/f	V_{PILOT} = 32mV		–	4	–	%
Temperature Drift (Uncompensated)	T_C			–	+200	–	ppm/°C
Muting Circuit (Pin11)							
Input Voltage (Mute "ON")	V_{Dlow}			–	–	0.8	V
Input Voltage (Mute "OFF")	V_{Dhigh}			2.0	–	8.0	V
Input Current (Mute "ON")	$-I_{Dlow}$			25	10	–	µA
Input Current (Mute "OFF")	I_{Dhigh}			–	–	TBD	µA
Source Selector (Pin10) Switching Level							
Cassette–to–Radio	V_{Clow}			–	–	0.8	V
	$-I_{Clow}$			25	10	–	µA
Radio–to–Cassette	V_{Chigh}			2.0	–	8.0	V
	I_{Chigh}			–	–	TBD	µA

Note 3. Reference output voltage at 1kHz (measured channel R (Pin2)).

Note 7. ACI (Adjacent Channel Interference):

$$\alpha 114 = \frac{V_O \text{ (signal) at 1kHz}}{V_O \text{ (spurious) at 4kHz}} \ : \ f_S = 110\text{kHz} - (3 \times 38\text{kHz})$$

$$\alpha 190 = \frac{V_O \text{ (signal) at 1kHz}}{V_O \text{ (spurious) at 4kHz}} \ : \ f_S = 186\text{kHz} - (3 \times 38\text{kHz})$$

measured with: 90% mono signal; f_S = 1kHz; 9% pilot signal; 1% spurious signal (f_S = 110 or 186kHz, unmodulated).

Pin Connection Diagram