

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 ($T_A = +25^\circ\text{C}$), P_{TOT} 1.6W
 Operating Ambient Temperature Range, T_A -30° to $+80^\circ\text{C}$
 Storage Temperature Range, T_{stg} -55° to $+150^\circ\text{C}$
 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: ($V_{CC} = 8.5V$, $T_A = +25^{\circ}C$ 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 $T_A = +25^{\circ}C$)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Gain Input Amplifier	A_V		–	–	20	dB
Input Impedance (External)	Z_I		–	47	–	k Ω
Maximum Input Voltage	V_I		–	–	TBD	V_{P-P}
Gain Output Buffers	A_V		–	10	–	dB
Maximum Output Voltage	$V_{O12, 16}$	THD $\leq 1\%$	–	–	TBD	V_O
Output Impedance	Z_O	Pin12, Pin16	–	–	500	Ω
Maximum Load Impedance	Z_L		5.0	–	–	k Ω
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	$V_{12} = V_{16}$		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 $T_A = +25^\circ C$)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
SDS Control						
10dB Channel Separation	V4		–	1.0	–	V
Full Stereo	V4	Channel Separation $\geq 26dB$	–	1.2	–	V
Full Mono	V4	Channel Separation $\geq 1dB$	–	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	α_{19}	$f = 19kHz$, $R6-5 = 180k\Omega$, Note 2	32	40	–	dB
Subcarrier	α_{38}	$f = 38kHz$	–	45	–	dB
	α_{57}	$f = 57kHz$	–	50	–	dB
	α_{228}	$f = 228kHz$	–	75	–	dB
Intermodulation	α_2	$f_M = 10kHz$, spurious signal, $f_S = 1kHz$, Note 4	–	50	–	dB
	α_3	$f_M = 13kHz$, spurious signal, $f_S = 1kHz$, Note 4	–	50	–	dB
Traffic Radio (VWF) Suppression	α_{57} (VWF)	$f = 57kHz$, Note 5	–	80	–	dB
SCA (Subsidiary Communications Authorization)	α_{67}	$f = 67kHz$, 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):

$$\alpha_2 = \frac{V_O \text{ (signal) at 1kHz}}{V_O \text{ (spurious) at 1kHz}} : f_S = (2 \times 10kHz) - 19kHz$$

$$\alpha_3 = \frac{V_O \text{ (signal) at 1kHz}}{V_O \text{ (spurious) at 1kHz}} : f_S = (3 \times 13kHz) - 38kHz$$

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

Note 5. Traffic ratio (VWF) suppression:

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

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 (Subsidiary Communications Authorization):

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

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 $T_A = +25^{\circ}C$)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit	
Carrier and Harmonic Suppression at the Output (Cont'd) (Note 3)							
ACI (Adjacent Channel Interference)	α_{114}	$f = 114kHz$, Note 7	–	90	–	dB	
	α_{190}	$f = 190kHz$, Note 7	–	60	–	dB	
Ripple Rejection	RR100	$f = 100Hz$, $V_{RIPPLE} = 100mV$	$V_9 = 8.5V$	–	46	–	dB
			$V_9 = 7.0V$	–	TBD	–	dB
VCO (Voltage–Controlled Oscillator)							
Oscillator Frequency Adjustable with R8	f_{OSC}		–	228	–	kHz	
Capture Range (Deviation from 228kHz Center Frequency)	$\Delta f/f$	$V_{PILOT} = 32mV$	–	4	–	%	
Temperature Drift (Uncompensated)	T_C		–	+200	–	ppm/ $^{\circ}C$	
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):

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

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

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

Pin Connection Diagram

