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## NTE867 Integrated Circuit BiMOS Input Op-Amp

**Description:**

The NTE867 is a linear integrated circuit that has three major sections for interfacing television tuning systems: an input op-amp, a band-select switch, and an internally referenced quad-comparator. The op-amp output voltage has a wide dynamic range with a 3mA source or sink capability and can be clamped to three discrete levels in response to logic inputs. The op-amp also has internal bias reference and phase compensation. High impedance PMOS input transistors are protected by input limiting diode clippers.

The band-select switch has two logic inputs controlling four outputs: VHF B+, VHF HIGH, SUPER-BAND CATV, and UHF B+. The VHF B+ and UHF B+ outputs are current sources which are short-circuit protected by current limiting. VHF HIGH and SUPERBAND CATV outputs are current sinks with low off-state leakage. The quad comparator features internal reference bias, low output leakage, and a 6mA current sinking capability. The outputs of two of the comparators are internally connected to form a window comparator.

**Features:**

- Input op-amp: high impedance PMOS input transistors and internal reference bias
- Low input bias current and internal diode protection at op-amp inputs
- High op-amp output voltage swing (0.7-28.0V) with 3mA source sink capability
- Three op-amp output voltage logic-controlled clamp levels
- Logic-controlled bandswitching with four separate outputs
- Two bandswitch output current sinks
- Two bandswitch current-limited output current sources
- Internally referenced quad comparator
- Low drive current input requirement
- Low output leakage
- High output current sink capability
- Bipolar and PMOS processes on a single chip

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

Supply Current, $I_{SS}$ .....	20mA
Supply Voltage (Pin 8), $V_{CC}$ .....	$\pm 18\text{V}$
Supply Voltage (Pin 12), $V_{DD}$ .....	$\pm 8\text{V}$
Device Dissipation Per Package, $P_D$	
Up to $55^\circ\text{C}$ .....	750mW
Above $55^\circ\text{C}$ (Derate Linearly) .....	7.9mW/ $^\circ\text{C}$
Operating Ambient Temperature Range, $T_A$ .....	$0^\circ$ to $+70^\circ\text{C}$
Storage Ambient Temperature Range .....	$-55^\circ\text{C}$ to $+150^\circ\text{C}$

**Electrical Characteristics:** ( $T_A = +25^\circ\text{C}$ ,  $I_{SS} = 9\text{mA}$ ,  $V_{DD} = 5\text{V}$ ,  $V_{CC} = 12\text{V}$ , unless otherwise specified)

Parameter	Test Conditions	Min	Max	Unit
$I_{CC}$ Supply Current, $I_8$	All Outputs Open	0.1	2	mA
$I_{DD}$ Supply Current, $I_{12}$	All Outputs Open	0.1	1.5	mA
Tuning Voltage Supply Regulation, $V_{17}$	$I_{SS} = 9\text{mA}$	29	35	V
$V_{17}$ Regulation, $\Delta V_{17}$	$V_1 = V_{17} @ I_{SS} = 6\text{mA}$ , $V_2 = V_{17} @ I_{SS} = 12\text{mA}$ , $\Delta V_{17} =  V_1 - V_2 $	0	0.8	V
Input Bias Current, $I_{10}$ BIAS L	$V_{10} = 0\text{V}$	-	-750	nA
Input Bias Current, $I_{10}$ BIAS H	$V_{10} = 6\text{V}$	1	-0.450	mA
Input Bias Current, $I_{15}$ BIAS L	$V_{15} = 0\text{V}$	0	-250	nA
Input Bias Current, $I_{15}$ BIAS H	$V_{15} = 6\text{V}$	1	-0.160	mA
Output Sink Current, $I_{11}$ Sink	$V_{10} = 0\text{V}$ , $V_{11} = 1.5\text{V}$	6	-	mA
Output Sink Current, $I_{11}$ Sink	$V_{10} = 6\text{V}$ , $V_{11} = 1.5\text{V}$	6	-	mA
Output Saturation Voltage, $V_{11}$ SAT1	$V_{10} = 0\text{V}$ , $I_{11}$ SINK = 4mA	100	700	mV
Output Saturation Voltage, $V_{11}$ SAT2	$V_{10} = 6\text{V}$ , $I_{11}$ SINK = 4mA	100	700	mV
Output Leakage Current, $I_{11}$ LEAKAGE	$V_{10} = 2.25\text{V}$ , $V_{11} = 12\text{V}$	-0.2	1.0	$\mu\text{A}$
Output Sink Current, $I_{13}$ SINK	$V_{10} = 6\text{V}$ , $V_{13} = 1.5\text{V}$	6	-	mA
Output Saturation Voltage, $V_{13}$ SAT	$V_{10} = 6\text{V}$ , $I_{13}$ SINK = 4mA	100	700	mV
Output Leakage Current, $I_{13}$ LEAKAGE	$V_{10} = 2.25\text{V}$ , $V_{13} = 12\text{V}$	-0.2	1.0	$\mu\text{A}$
Output Sink Current $I_{14}$ SAT	$V_{15} = 0\text{V}$ , $V_{14} = 1.5\text{V}$	6	-	mA
Output Saturation Voltage, $V_{14}$ SAT	$V_{15} = 0\text{V}$ , $I_{14}$ SINK = 4mA	100	700	mV
Output Leakage Current, $I_{14}$ LEAKAGE	$V_{15} = 2.25\text{V}$ , $V_{14} = 12\text{V}$	-0.2	1.0	$\mu\text{A}$
AFT Center Reference Voltage, $V_{13}$ REF		2.8	3.2	V
AFT Window Reference Voltage Low, $V_{11}$ REF LOW		0.8	1.2	V
AFT Window Reference Voltage High, $V_{11}$ REF HIGH		4.95	5.05	V
Vertical Output Reference, $V_{14}$ REF		1.3	1.7	V

**Op-Amp Electrical Characteristics:** ( $T_A = +25^\circ\text{C}$ ,  $I_{SS} = 9\text{mA}$ ,  $V_{DD} = 5\text{V}$ ,  $V_{CC} = +12\text{V}$ ,  $V_H = 2.4\text{V Min.}$ ,  $V_L = 0.8\text{V Max.}$ ,  $V_A = \text{Pin 3}$ ,  $V_B = \text{Pin 4}$ , unless otherwise specified)

Parameter	$V_A$	$V_B$	Test Conditions	Min	Max	Unit
Bias Voltage, $V_1$ Bias	$V_L$	$V_L$	Pin 1 through 10K $\Omega$	2.35	2.65	V
Bias Voltage, $I_1$ Bias	$V_L$	$V_L$	Pin 1 to Ground	-	100	pA
Output Source Current $I_{16}$ Source	$V_L$	$V_L$	$V_1 = 0\text{V}$ , $V_{16} = 17.5\text{V}$	-3	-	mA
Output Sink Current, $I_{16}$ Sink	$V_L$	$V_L$	$V_1 = 5\text{V}$ , $V_{16} = 17.5\text{V}$	3	-	mA
Output Sink Current, $I_{16}$ AOL	$V_L$	$V_L$	$I_{SS} = 10\text{mA}$ , $R_L = 10\text{K}\Omega$ , $V_1 = 2.5\text{V}$ , $V_{16} = 17.5\text{V}$	1	-	v/mV
High Clamp Output Voltage, $V_{16}$ HCL	$V_L$	$V_L$	$V_1 = 0\text{V}$	28	34	V
Low Clamp Output Voltage, $V_{16}$ CL1	$V_L$	$V_L$	$V_1 = 5\text{V}$	0.7	1.1	V
Low Clamp Output Voltage, $V_{16}$ CL2	$V_L$	$V_H$	$V_1 = 5\text{V}$	1.6	2.1	V
Low Clamp Output Voltage, $V_{16}$ CL3	$V_H$	$V_L$	$V_1 = 5\text{V}$	4.9	5.75	V

**Bandswitch Electrical Characteristics:** ( $T_A = +25^\circ\text{C}$ ,  $I_{SS} = 9\text{mA}$ ,  $V_{DD} = 5\text{V}$ ,  $V_{CC} = 12\text{V}$ ,  $V_H = 2.4\text{V}$  Min.,  $V_L = 0.8\text{V}$  Max.,  $V_A = \text{Pin 3}$ ,  $V_B = \text{Pin 4}$ ,  $V_I = 5\text{V}$ , unless otherwise specified)

Parameter	$V_A$	$V_B$	Test Conditions	Min	Max	Unit
Pin 7 ON (VHF ON)	$V_H$	$V_L$	$I_7 = 15\text{mA}$	11.3	-	V
Pin 9 ON (UHF ON)	$V_H$	$V_H$	$I_9 = -15\text{mA}$	11.3	-	V
Pin 7 ON (VHF OFF)	$V_H$	$V_H$	$I_7 = 1\text{mA}$	-	1.5	V
Pin 9 OFF (UHF OFF)	$V_H$	$V_L$	$I_9 = 1\text{mA}$	-	1.5	V
VHF Short Circuit Current, $I_7 \text{ SC}$	$V_L$	$V_L$		20	45	mA
UHF Short Circuit Current, $I_9 \text{ SC}$	$V_H$	$V_H$		20	45	mA
V5 Saturation Voltage, $V_5 \text{ SAT}$	$V_H$	$V_L$	$I_5 = 2.5\text{mA}$	-	0.5	V
V6 Saturation Voltage, $V_6 \text{ SAT}$	$V_H$	$V_L$	$I_6 = 2.5\text{mA}$	-	0.5	V
Bandswitch Leakage Current, $I_5 \text{ L}$	$V_L$	$V_L$	$V_5 = 15\text{V}$	-0.2	1	$\mu\text{A}$
Superbandswitch Leakage Current, $I_6 \text{ L}$	$V_L$	$V_L$	$V_6 = 15\text{V}$	-0.2	1	$\mu\text{A}$
Logic Input Low Current, $I_3 \text{ L}$	-	-	$V_A = 0\text{V}$ , $V_B = 5\text{V}$	0	-30	$\mu\text{A}$
Logic Input Low Current, $I_4 \text{ L}$	-	-	$V_A = 5\text{V}$ , $V_B = 0\text{V}$	0	-30	$\mu\text{A}$
Logic Input High Input Current, $I_3 \text{ H}$	-	-	$V_A = 5\text{V}$ , $V_B = 0\text{V}$	-	1	$\mu\text{A}$
Logic Input High Input Current, $I_4 \text{ H}$	-	-	$V_A = 0\text{V}$ , $V_B = 5\text{V}$	-	1	$\mu\text{A}$

**Logic Table for Bandswitch and Op-Amp Outputs:**

Inputs			Band	Outputs					
Op-Amp Pin 1	$V_A$ Pin 3	$V_B$ Pin 4		VHF B+ SRC Pin 7	UHF B+ SRC Pin 9	VHF High Sink Pin 5	Bandswitch CATV Sink Pin 6	Pin 16 Voltage	
								Min.	Max
1	0	0	Low VHF	ON	OFF	OFF	OFF	0.7V	1.1V
1	0	1	High VHF Midband CATV	ON	OFF	ON	OFF	1.6V	2.1V
1	1	0	Superband CATV	ON	OFF	ON	ON	4.9V	5.75V
1	1	1	UHF	OFF	ON	ON	OFF	0.7V	1.1V
0	0	0		ON	OFF	OFF	OFF	28V	34V
0	0	1		ON	OFF	ON	OFF	28V	34V
0	1	0		ON	OFF	ON	ON	28V	34V
0	1	1		OFF	ON	ON	OFF	28V	34V

### Pin Connection Diagram

