NTE928S
Integrated Circuit
Low Power Dual Operational Amplifier

Description:

Utilizing the circuit designs perfected for recently introduced Quad Operational Amplifiers, the NTE928S dual operational amplifier features low power drain, a common mode input voltage range extending to ground/V_{EE}, and Single Supply or Split Supply Operation.

This amplifier has several distinct advantages over standard operational amplifier types in single supply applications. It can operate at supply voltages as low as 3.0 Volts or as high as 32 Volts with quiescent currents about one–fifth of those associated with the NTE941 (on a per amplifier basis). The common mode input range includes the negative supply, thereby eliminating the necessity for external biasing power supply voltage.

Features:

- Short Circuit Protected Outputs
- True Differential Input Stage
- Single Supply Operation: 3.0 to 32 Volts
- Low Input Bias Currents
- Internally compensated
- Common Mode Range Extends to Negative Supply
- Single and Split Supply Operation

Maximum Ratings:

Power Supply Voltages

Single Supply, V_{CC} 32V

Split Supplies, V_{CC} V_{EE} . . . . ±16V

Input Differential Voltage Range (Note 1), V_{IDR} . . . . ±32V

Input Common Mode Voltage Range (Note 2), V_{ICR} . . . . −0.3 to 32V

Input Forward Current (V_I −0.3V, Note 3), I_{IF} 50mA

Output Short Circuit Duration, t_S . . . . Continuous

Junction Temperature, T_J . . . . −55° to +125°C

Operating Ambient Temperature Range, T_A . . . . 0° to +70°C

Note 1. Split Power Supplies

Note 2. For supply voltages less than 32V, the absolute maximum input voltage is equal to the supply voltage.

Note 3. This input current will only exist when the voltage is negative at any of the input leads. Normal output states will reestablish when the input voltage returns to a voltage greater than 0.3V.

Electrical Characteristics: (V_{CC} = 5V, V_{EE} = Gnd, T_A = +25°C unless otherwise specified)

Parameter	Symbol	Test Conditions		Min	Typ	Max	Unit
Input Offset Voltage	V_{IO}	V_{CC} = 5V to 30V, V_{IC} =0 to V_{CC}–1.7V, $V_O \simeq$ 1.4V, R_S = 0Ω		–	2.0	7.0	mV
			$0° \leq T_A \leq +70°C$	–	–	9.0	mV
Average Temperature Coefficient of Input Offset Voltage	$\Delta V_{IO}/\Delta T$	$0° \leq T_A \leq +70°C$		–	7.0	–	µV/°C
Input Offset Current	I_{IO}			–	5.0	50	nA
		$0° \leq T_A \leq +70°C$		–	–	150	nA
Average Temperature Coefficient of Input Offset Current	$\Delta I_{IO}/\Delta T$	$0° \leq T_A \leq +70°C$		–	10	–	pA/°C
Input Bias Current	I_{IB}			–	–45	–250	nA
		$0° \leq T_A \leq +70°C$		–	–50	–500	nA
Input Common–Mode Voltage Range	V_{ICR}	V_{CC} = 30V, Note 4		0	–	28.3	V
			$0° \leq T_A \leq +70°C$	0	–	28	V
Differential Input Voltage Range	V_{IDR}			–	–	V_{CC}	V
Large Signal Open–Loop Voltage Gain	A_{VOL}	R_L = 2kΩ, V_{CC} = 15V, For Large V_O Swing		25	100	–	V/mV
			$0° \leq T_A \leq +70°C$	15	–	–	V/mV
Channel Separation		1kHz $\leq$ f $\leq$ 20kHz, Input Referenced		–	–120	–	dB
Common–Mode Rejection Ratio	CMRR	$R_S \leq$ 10kΩ		65	70	–	dB
Power Supply Rejection Ratio	PSRR			65	100	–	dB
Output Voltage Range	V_{OR}	R_L = 2kΩ		0	–	3.3	V
Output Voltage – High Limit	V_{OH}	V_{CC} = 30V, $0° \leq T_A \leq +70°C$	R_L = 2kΩ	26	–	–	V
			R_L = 10kΩ	27	28	–	V
Output Voltage – Low Limit	V_{OL}	V_{CC} = 5V, R_L = 10kΩ, $0° \leq T_A \leq +70°C$		–	5	20	mV
Output Source Current	I_{O+}	V_{ID} = +1V, V_{CC} = 15V		20	40	–	mA
Output Sink Current	$I_{O–}$	V_{ID} = –1V, V_{CC} = 15V		10	20	–	mA
		V_{ID} = –1V, V_O = 200mV		12	50	–	µA
Output Short–Circuit to GND	I_{os}	Note 5		–	40	60	mA
Power Supply Current	I_{CC}	V_O = 0, R_L = ∞, $0° \leq T_A \leq +70°C$	V_{CC} = 30V	–	1.5	3.0	mA
			V_{CC} = 5V	–	0.7	1.2	mA

Note 4. The input common–mode voltage or either input signal voltage should not be allowed to go negative by more than 0.3V. The upper end of the common–mode voltage range is V_{CC}–1.7V, but either or both inputs can goto +32V without damage.

Note 5. Short circuit from the output to V_{CC} can cause excessive heating and eventual destruction. Destructive dissipation can result from simultaneous shorts on all amplifiers.

Pin Connection Diagram
(Front View)

Pin	Signal
9	V_{CC}
8	Output B
7	Inverting Input B
6	Non–Inverting Input B
5	V_{EE} (GND)
4	Non–Inverting Input A
3	Inverting Input A
2	Output A
1	V_{CC}

.126 (3.2)

.906 (23.0) Max

.323 (8.2) Max

1   9

.099 (2.5) Min

.100 (2.54)

.020 (0.50)

.800 (20.3)