Signetics

NE/SE5539 Ultra-High Frequency Operational Amplifier

Product Specification

Linear Products

DESCRIPTION

The NE/SE5539 is a very wide bandwidth, high slew rate, monolithic operational amplifier for use in video amplifiers, RF amplifiers, and extremely high slew rate amplifiers.

Emitter-follower inputs provide a true differential high input impedance device. Proper external compensation will allow design operation over a wide range of closed-loop gains, both inverting and non-inverting, to meet specific design requirements.

FEATURES

- Gain bandwidth product: 1.2GHz at 17dB
- Slew rate: 600/Vµs
- Full power response: 48MHz
- A_{VOL}: 52dB typical
- 350MHz unity gain

APPLICATIONS

- Fast pulse amplifiers
- RF oscillators
- Fast sample and hold
- High gain video amplifiers (BW > 20MHz)

PIN CONFIGURATION



ORDERING INFORMATION

DESCRIPTION	TEMPERATURE RANGE	ORDER CODE
14-Pin Plastic DIP	0 to +70°C	NE5539N
14-Pin Plastic SO	0 to +70°C	NE5539D
14-Pin Cerdip	0 to +70°C	NE5539F
14-Pin Plastic DIP	-55°C to +125°C	SE5539N
14-Pin Cerdip	-55°C to +125°C	SE5539F

ABSOLUTE MAXIMUM RATINGS¹

SYMBOL	PARAMETER	RATING	UNIT
V _{cc}	Supply voltage	± 12	v
PD	Internal power dissipation	550	mW
T _{STG}	Storage temperature range	-65 to +150	°C
Tj	Max junction temperature	150	°C
T _A	Operating temperature range NE SE	0 to 70 -55 to +125	°℃ ℃
T _{SOLD}	Lead temperature (10sec max)	300	°C

NOTE:

 Differential input voltage should not exceed 0.25V to prevent excessive input bias current and common-mode voltage 2.5V. These voltage limits may be exceeded if current is limited to less than 10mA.

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EQUIVALENT CIRCUIT



DC ELECTRICAL CHARACTERISTICS $V_{CC} = \pm 8V$, $T_A = 25^{\circ}C$, unless otherwise specified.

		PARAMETER TEST CONDITIONS			SE5539			NE5539			
SYMBOL	PARAMETER				Тур	Max	Min	Тур	Max	UNIT	
N		V = 0V B = 1000	Over temp		2	5					
vos	os input onset voltage	VO = 0V, HS = 10032	T _A = 25°C		2	3		2.5	5	mv	
	$\Delta V_{OS} / \Delta T$				5			5		μV/°C	
los	Input offset current		Over temp		0.1	3					
			T _A = 25°C		0.1	1		-	2	2	
	$\Delta I_{OS} / \Delta T$				0.5			0.5		nA/°C	
	Input bias current		Over temp		6	25					
'8			T _A = 25°C		5	13		5	20	_ μΛ	
	ΔI _B /ΔT				10			10		nA/°C	
CMRR	Common-mode rejection ratio	F = 1kHz, R _S = 100Ω, \	/ _{СМ} ± 1.7V	70	80		70	80		dB	
			Over temp	70	80					dB	
R _{IN}	Input impedance				100			100		kΩ	
R _{OUT}	Output impedance				10			10		Ω	

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STMBOL	PARAMETER	IES	TEST CONDITIONS			Тур	Max	Min	Тур	Max	UNIT	
		$R_{L} = 150\Omega$ to	$R_L = 150\Omega$ to GND and		1			+2.3	+ 2.7			
VOUT	Output voltage swing	470Ω to	-V _{CC}	-Swing				-1.7	-2.2			
				0	+ Swing	+ 2.3	+ 3.0					v
N	Output veltage swing	$R_L = 2k\Omega$ to		-Swing	-1.5	-2.1					V	
VOUT	GND GND	T 25°C	+ Swing	+ 2.5	+ 3.1							
			$I_A = 25^{\circ}C$	-Swing	-2.0	-2.7					v	
1+	Positivo aupply surront	$V_0 = 0, R_1 = \infty$		Over temp		14	18				mA	
1CC+	Positive supply current			T _A = 25°C		14	17		14	18		
				Over temp		11	15					
ICC-	Negative supply current	$v_0 = 0, r$	1 ₁ = ∞	T _A = 25°C		11	14		11	15		
DEDD	Bower events rejection ratio		+ 11/	Over temp		300	1000					
Fonn		$\Delta V_{CC} = \pm 1V$		T _A = 25°C					200	1000	μν/ν	
A _{VOL}	Large signal voltage gain	V ₀ = R _L = 150Ω	$V_0 = +2.3V, -1.7V$ R _L = 150 Ω to GND, 470 Ω to -V _{CC}					47	52	57	dB	
		$V_{0} = +2.3$ V	V, -1.7V								40	
AVOL	Large signal voltage gain	$R_L = 2\Omega$ to GND		T _A = 25°C				47	52	57	ub	
		$V_0 = +2.5$	$V_0 = +2.5V_1 - 2.0V$		46		60				dP	
AVOL	Large signai voltage gain	$R_L = 2k\Omega$ to GND		T _A = 25°C	48	53	58]			dB	

DC ELECTRICAL CHARACTERISTICS (Continued) $V_{CC} = \pm 8V$, $T_A = 25^{\circ}C$, unless otherwise specified.

DC ELECTRICAL CHARACTERISTICS $V_{CC} = \pm 6V$, $T_A = 25^{\circ}C$, unless otherwise specified.

000000		TEAT	SE5539					
STMBOL	PARAMETER	TEST C	UNDITIONS	Min	Тур	Max	UNIT	
V				Over temp		2	5	
VOS				T _A = 25°C		2	3	niv
				Over temp		0.1	3	
'OS				T _A = 25°C		0.1	1	μΑ
	Input bies surrent			Over temp		5	20	
В			T _A = 25°C			4	10	
CMRR	Common-mode rejection ratio	$V_{CM} = \pm 1.3V, R_{S} = 100\Omega$			70	85		dB
lt	Positive events	Over		Over temp		11	14	
				T _A = 25°C		11	13	
	Nogetive supply surrent			Over temp		8	11	-
ICC-	Negative supply current		T _A = 25°C		8	10		
DEBB	Bower eventy rejection ratio			Over temp		300	1000	
Fonn		$\Delta v_{CC} = \pm 1 v$ $T_A = 2i$	T _A = 25°C				μ • / •	
			Over tomp	+ Swing	+1.4	+ 2.0		
		$R_{L} = 150\Omega$ to GND	Over temp	-Swing	-1.1	-1.7		
™ OUT	Culput voltage swing	and 390 Ω to -V_{CC}	T	+ Swing	+1.5	+ 2.0		`
			14 - 25 C	-Swing	-1.4	-1.8		

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AC ELECTRICAL CHARACTERISTICS $V_{CC} = \pm 8V$, $R_L = 150\Omega$ to GND & 470 Ω to $-V_{CC}$, unless otherwise specified.

	PARAMETER		SE5539						
SYMBOL		TEST CONDITIONS	Min	Тур	Max	Min	Тур	Max	UNIT
BW	Gain bandwidth product	$A_{CL} = 7, V_0 = 0.1 V_{P.P}$		1200			1200		MHz
	Small-signal bandwidth	$A_{CL} = 2, R_L = 150\Omega^1$		110			110		MHz
ts	Settling time	$A_{CL} = 2, R_{L} = 150\Omega^{1}$		15			15		ns
SR	Slew rate	$A_{CL} = 2, R_L = 150\Omega^1$		600			600		V/µs
t _{PD}	Propagation delay	$A_{CL} = 2, R_L = 150\Omega^1$		7			7		ns
	Full power response	$A_{CL} = 2, R_L = 150\Omega^1$		48			48		MHz
	Full power response	$A_V = 7, R_L = 150\Omega^1$		20			20		MHz
	Input noise voltage	R _S = 50Ω		4			4		nV/√Hz

NOTE:

1. External compensation.

AC ELECTRICAL CHARACTERISTICS $V_{CC} = \pm 6V$, $R_L = 150\Omega$ to GND and 390Ω to $-V_{CC}$, unless otherwise specified.

SYMBOL	PARAMETER					
		TEST CONDITIONS	Min	Тур	Max	UNIT
BW	Gain bandwidth product	A _{CL} = 7		700		MHz
	Small-signal bandwidth	$A_{CL} = 2^{1}$		120		MHz
ts	Settling time	$A_{CL} = 2^{\dagger}$		23		ns
SR	Slew rate	$A_{CL} = 2^1$		330		V/µs
t _{PD}	Propagation delay	$A_{CL} = 2^1$		4.5		ns
	Full power response	$A_{CL} = 2^1$		20		MHz

NOTE:

1. External compensation.

TYPICAL PERFORMANCE CURVES



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Ultra-High Frequency Operational Amplifier

TYPICAL PERFORMANCE CURVES (Continued)



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CIRCUIT LAYOUT CONSIDERATIONS

As may be expected for an ultra-high frequen-

cal circuit layout is extremely critical. Breadboarding is not recommended. A doublesided copper-clad printed cirucit board will result in more favorable system operation. An example utilizing a 28dB non-inverting amp is shown in Figure 1.



NE5539 COLOR VIDEO AMPLIFIER

The NE5539 wideband operational amplifier is easily adapted for use as a color video amplifier. A typical circuit is shown in Figure 2 along with vector-scope¹ photographs showing the amplifier differential gain and phase response to a standard five-step modulated staircase linearity signal (Figures 3, 4 and 5). As can be seen in Figure 4, the gain varies less than 0.5% from the bottom to the top of the staircase. The maximum differential phase shown in Figure 5 is approximately +0.1°.

The amplifier circuit was optimized for a 75Ω input and output termination impedance with a gain of approximately 10 (20dB).

NOTE:

1. The input signal was 200mV and the output 2V. V_{CC} was ±8V.



Figure 2. NE5539 Video Amplifier



1. Instruments used for these measurements were Tektronix, 146 NTSC test signal generator, 520A NTSC vectorscope, and 1480 waveform monitor.

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APPLICATIONS



