

NE/SA5214 Postamplifier with Link Status Indicator

Preliminary Specification

Linear Products

DESCRIPTION

THE NE/SA5214 is a 75MHz postamplifier system designed to accept low level high-speed signals. These signals are converted into a TTL level at the output. The NE5214 can be DC coupled with the previous transimpedance stage using NE5210, NE5211 or NE5212 transimpedance amplifiers. This "system on a chip" features an auto-zeroed first stage with noise shaping, a symmetrical limiting second stage, and a matched rise/fall time TTL output buffer. The system is user-configurable to provide noise filtering, adjustable input thresholds and hysteresis. The threshold capability allows the user to maximize signal-to-noise ratio, insuring a low Bit Error Rate (BER). An Auto-Zero loop can be used to minimize the number of external coupling capacitors to one. A signal absent flag indicates when signals are below threshold. Additionally, the low signal condition forces the overall TTL output to a logical Low level. User interaction with this "jamming" system is available. The NE/SA5214 is packaged in a standard 20-pin surface-mount package and typically consumes 42mA from a standard 5V supply. The NE/SA5214 is designed as a companion to the NE/SA5211/5212 transimpedance amplifiers. These differential preamplifiers may be directly coupled to the post-amplifier inputs. The NE/SA5214 or NE/SA5211/5214 combinations convert nanoamps of photodetector current into standard digital TTL levels.

ORDERING INFORMATION

DESCRIPTION	TEMPERATURE RANGE	ORDER CODE
20-Pin Plastic SOL	0 to +70°C	NE5214D
20-Pin Plastic SOL	-40°C to +85°C	SA5214D

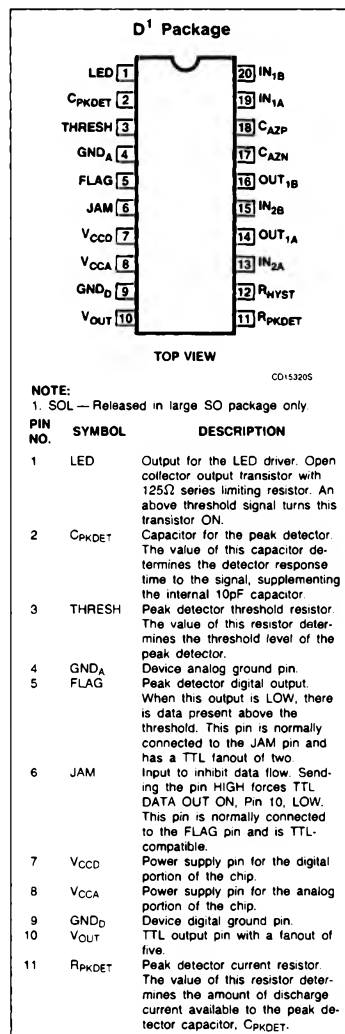
FEATURES

- Postamp for the NE/SA5211/5212 preamplifier family
- Wideband operation: typical 75MHz (100MBAud NRZ)
- Interstage filtering/equalization possible
- Single 5V supply
- Low signal flag
- Low signal output disable
- Link status threshold and hysteresis programmable
- LED driver (normally ON with above threshold signal)
- Fully differential for excellent PSRR
- Auto-zero loop for DC offset cancellation
- 2kV ElectroStatic Discharge (ESD) protection

APPLICATIONS

- Fiber optics
- Communication links in Industrial and/or Telecom environment with high EMI/RFI
- Local Area Networks (LAN)
- Metropolitan Area Networks (MAN)
- Synchronous Optical Networks (SONET)
- RF limiter

PIN CONFIGURATION



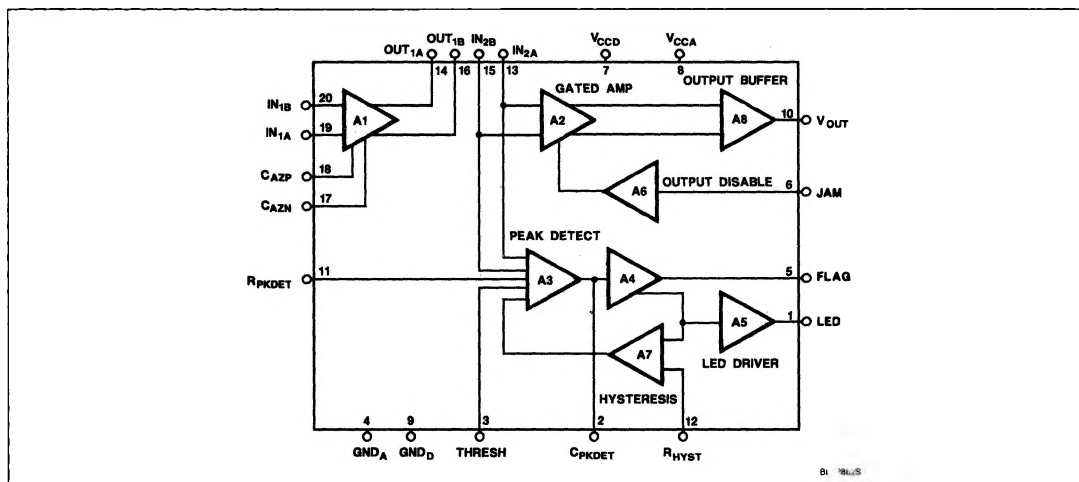
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PIN CONFIGURATION (cont.)

PIN NO.	SYMBOL	DESCRIPTION
12	R_{HYST}	Peak detector hysteresis resistor. The value of this resistor determines the amount of hysteresis in the peak detector.
13	IN_{2A}	Non-inverting input to amplifier A2.
14	OUT_{1A}	Non-inverting output of amplifier A1.
15	IN_{2B}	Inverting input to amplifier A2.
16	OUT_{1B}	Inverting output of amplifier A1.
17	CA_{2N}	Auto-Zero capacitor pin (Negative terminal). The value of this capacitor determines the low-end frequency response of the preamp A1.
18	CA_{2P}	Auto-Zero capacitor pin (Positive terminal). The value of this capacitor determines the low-end frequency response of the preamp A1.
19	IN_{1A}	Non-inverting input of the preamp A1.
20	IN_{1B}	Inverting input of the preamp A1.

BLOCK DIAGRAM



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ABSOLUTE MAXIMUM RATINGS

SYMBOL	PARAMETER	RATING		UNIT
		NE5214	SA5214	
V _{CCA}	Power supply	+6	+6	V
V _{CCD}	Power supply	+6	+6	V
T _A	Operating ambient temperature range	0 to +70	-40 to +85	°C
T _J	Operating junction temperature range	-55 to +150	-55 to +150	°C
T _{STG}	Storage temperature range	-65 to +150	-65 to +150	°C
P _D	Power dissipation	300	300	mW
V _{IJ}	Jam input voltage	-0.5 to 5.5	-0.5 to 5.5	V

RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	RATING		UNIT
		NE5214	SA5214	
V _{CCA}	Supply voltage	4.75 to 5.25	4.75 to 5.25	V
V _{CCD}	Power supply	4.75 to 5.25	4.75 to 5.25	V
T _A	Ambient temperature range	0 to +70	-40 to +85	°C
T _J	Operating junction temperature range	0 to +95	-40 to +110	°C
P _D	Power dissipation	250	250	mW

DC ELECTRICAL CHARACTERISTICS Min and Max limits apply over the operating temperature range at
V_{CCA} = V_{CCD} = +5.0V unless otherwise specified. Typical data applies at
V_{CCA} = V_{CCD} = +5.0V and T_A = 25°C.

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS						UNIT
			NE5214			SA5214			
			Min	Typ	Max	Min	Typ	Max	
I _{CCA}	Analog supply current			30	36		30	37.2	mA
I _{CCD}	Digital supply current (TTL, Flag, LED)			10	13.3		10	13.5	mA
V _{I1}	A1 input bias voltage (+/- inputs)		3.16	3.4	3.63	3.13	3.4	3.65	V
V _{O1}	A1 output bias voltage (+/- outputs)		3.17	3.8	4.45	3.10	3.8	4.50	V
A _{V1}	A1 DC gain (without Auto-Zero)			30			30		dB
A1 _{PSRR}	A1 PSRR (V _{CCA} , V _{CCD})	V _{CCA} = V _{CCD} = 4.75 to 5.25V		60			60		dB
A1 _{CMRR}	A1 CMRR	ΔV _{CM} = 200mV		60			60		dB
V _{I2}	A2 input bias voltage (+/- inputs)		3.59	3.7	3.85	3.56	3.7	3.86	V
V _{OH}	High-level TTL output voltage	I _{OH} = -200μA	2.4	3.4		2.4	3.4		V
V _{OL}	Low-level TTL output voltage	I _{OL} = 8mA		0.3	0.4		0.3	0.4	V
I _{OH}	High-level TTL output current	V _{OUT} = 2.4V		-40	-26		-40	-24.4	mA
I _{OL}	Low-level TTL output current	V _{OUT} = 0.4V	8.0	30		7.0	30		mA

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DC ELECTRICAL CHARACTERISTICS (Continued) Min and Max limits apply over the operating temperature range at $V_{CCA} = V_{CCD} = +5.0V$ unless otherwise specified. Typical data applies at $V_{CCA} = V_{CCD} = +5.0V$ and $T_A = 25^\circ C$.

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS						UNIT
			NE5214			SA5214			
			Min	Typ	Max	Min	Typ	Max	
I _{OS}	Short-circuit TTL output current	V _{OUT} = 0.0V		-95			-95		mA
V _{THRESH}	Threshold bias voltage	Pin 3 Open		0.75			0.75		V
V _{RPKDET}	RPKDET	Pin 11 Open		0.72			0.72		V
V _{RHYST}	RHYST bias voltage	Pin 12 Open		0.72			0.72		V
V _{I_{HJ}}	High-level jam input voltage		2.0			2.0			V
V _{I_{LJ}}	Low-level jam input voltage				0.8			0.8	V
I _{I_{HJ}}	High-level jam input current	V _{I_J} = 2.7V			20			30	μA
I _{I_{LJ}}	Low-level jam input current	V _{I_J} = 0.4V	-450	-240		-485	-240		μA
V _{OHF}	High-level flag output voltage	I _{OH} = -80μA	2.4	3.8		2.4	3.8		V
V _{OLF}	Low-level flag output voltage	I _{OL} = 3.2mA		0.33	0.4		0.33	0.4	V
I _{OHF}	High-level flag output current	V _{OUT} = 2.4V		-18	-5.3		-18	-5	mA
I _{OLF}	Low-level flag output current	V _{OUT} = 0.4V	3.6	10		3.25	10		mA
I _{SCF}	Short-circuit flag output current	V _{OUT} = 0.0V	-60	-40	-25	-61	-40	-26	mA
I _{LEDH}	LED ON maximum sink current	V _{LED} = 3.0V	13	22	80	8	22	80	mA

AC ELECTRICAL CHARACTERISTICS Min and Max limits apply over the operating temperature range at $V_{CCA} = V_{CCD} = +5.0V$ unless otherwise specified. Typical data applies at $V_{CCA} = V_{CCD} = +5.0V$ and $T_A = 25^\circ C$.

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS						UNIT
			NE5214			SA5214			
			Min	Typ	Max	Min	Typ	Max	
f _{OP}	Maximum operating frequency	Test circuit	60	75		60	75		MHz
BW _{A1}	Small signal bandwidth (differential OUT ₁ /IN ₁)	Test circuit		75			75		MHz
V _{INH}	Maximum Functional A1 input signal (single ended)	Test Circuit		1.6			1.6		V _{P,P}
V _{INL}	Minimum Functional A1 input signal (single ended)	Test Circuit ¹		12			12		mV _{P,P}
R _{IN1}	Input resistance (differential at IN ₁)			1200			1200		Ω
C _{IN1}	Input capacitance (differential at IN ₁)			2			2		pF
R _{IN2}	Input resistance (differential at IN ₂)			1200			1200		Ω
C _{IN2}	Input capacitance (differential at IN ₂)			2			2		pF

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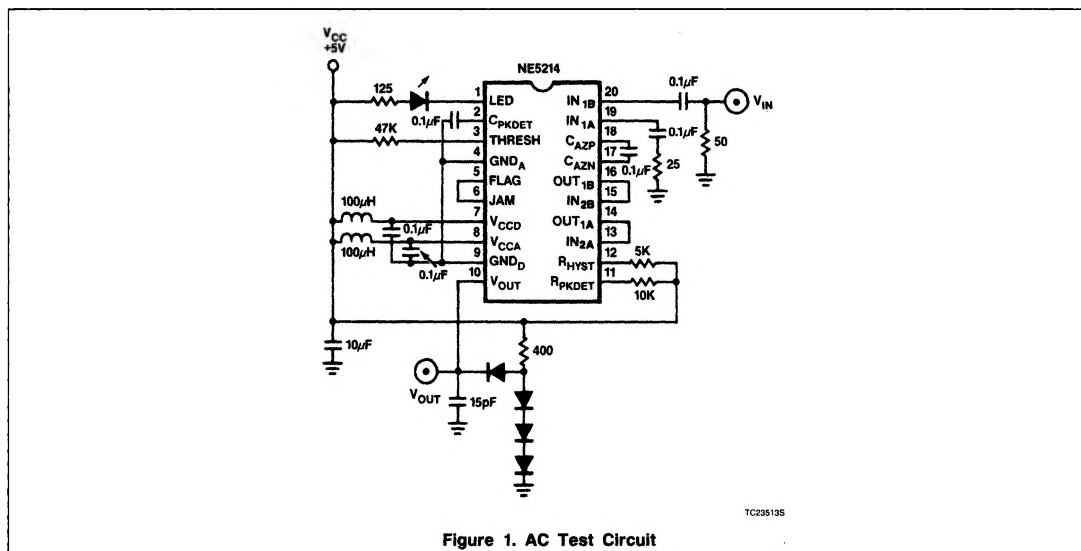
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AC ELECTRICAL CHARACTERISTICS (Continued) Min and Max limits apply over the operating temperature range at $V_{CCA} = V_{CCD} = +5.0V$ unless otherwise specified. Typical data applies at $V_{CCA} = V_{CCD} = +5.0V$ and $T_A = 25^\circ C$.

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS						UNIT			
			NE5214			SA5214						
			Min	Typ	Max	Min	Typ	Max				
R _{OUT1}	Output resistance (differential at OUT ₁)			25			25		Ω			
C _{OUT1}	Output capacitance (differential at OUT ₁)			2			2		pF			
V _{HYS}	Hysteresis voltage	Test circuit		3			3		mV _{p,p}			
V _{THR}	Threshold voltage range (FLAG ON)	Test circuit, @ 50MHz R _{RHYS} =5k R _{THRESH} = 47k		12			12		mV _{p,p}			
t _{TLH}	TTL Output Rise Time 20% to 80%	Test Circuit		1.3			1.3		ns			
t _{THL}	TTL Output Fall Time 80% to 20%	Test Circuit		1.2			1.2		ns			
t _{RFD}	t _{TLH} /t _{THL} mismatch			0.1			0.1		ns			
t _{PWD}	Pulse width distortion of output	50mV _{p,p} , 1010. . .input Distortion = <table><tr><td>$\frac{T_H - T_L}{T_H + T_L}$</td><td rowspan="2">10²</td></tr><tr><td>$\frac{T_H + T_L}{T_H + T_L}$</td></tr></table>	$\frac{T_H - T_L}{T_H + T_L}$	10 ²	$\frac{T_H + T_L}{T_H + T_L}$	2.5				2.5		%
$\frac{T_H - T_L}{T_H + T_L}$	10 ²											
$\frac{T_H + T_L}{T_H + T_L}$												

NOTE:

1. The NE/SA5214 is capable of detecting a much lower input level. Operation under 12mV_{p,p} cannot be guaranteed by present day automatic testers.

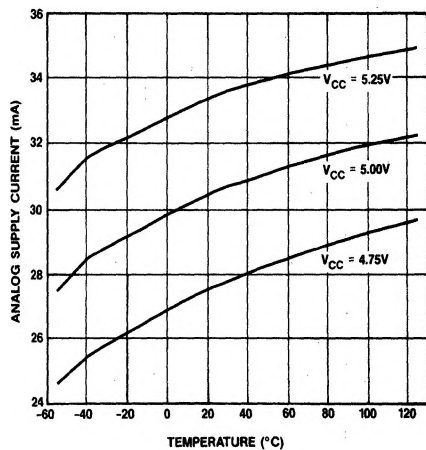


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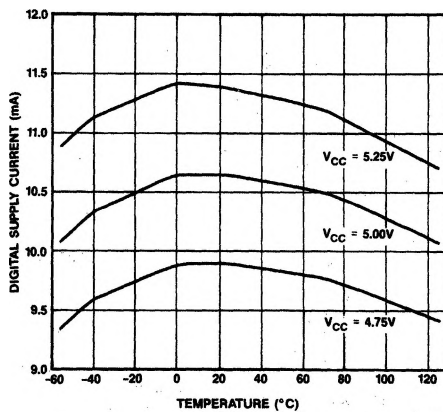
TYPICAL PERFORMANCE CHARACTERISTICS

Analog Supply Current vs Temperature

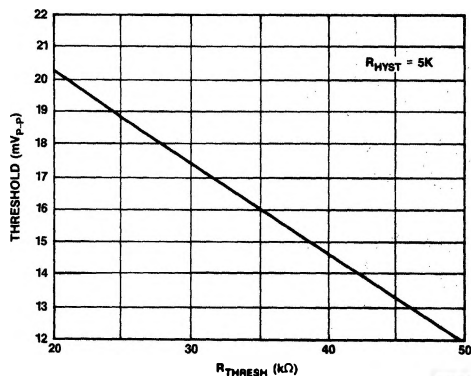


OP210405

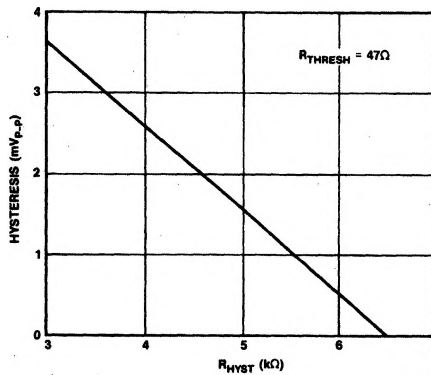
Digital Supply Current vs Temperature



OP210305

Threshold Voltage vs R_{THRESH} 

OP210105

Hysteresis Voltage vs R_{HYST} 

OP210205

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THEORY OF OPERATION AND APPLICATION INFORMATION

The NE 5214 postamplifier system is a highly integrated chip that provides up to 60dB of gain at 60MHz, to bring mV level signals up to TTL levels.

The NE5214 contains eight amplifier blocks (see Block Diagram). The main signal path is made up of a cascade of limiting stages: A1, A2 and A8. The A3-A4-A7 path performs a wideband full-wave rectification of the input signal with adjustable hysteresis and decay times. It outputs a TTL HIGH on the "FLAG" output (Pin 5) when the input is below a user adjustable threshold. An on-chip LED driver turns the external LED to the ON state when

the input signal is above the threshold. In a typical application the "FLAG" output is tied back to the "JAM" input; this forces the TTL data OUT into a LOW state when no signal is present at the input.

An auto zero loop allows the NE5214 to be directly connected to a transimpedance amplifier such as the NE5210, NE5211, or NE5212 without coupling capacitors. This auto-zero loop cancels the transimpedance amplifier's DC offset, the NE5214 A1 offset, and the data-dependent offset in the PIN diode/transimpedance amplifier combination. For more information on the NE5214 Theory of Operation, please refer to paper titled "A Low Cost 100 MBaud Fiber-Optic Receiver" by W. Mack et al.

A typical application of the NE5214 postamplifier is depicted in Figure 2. The system uses the NE5211 transimpedance amplifier which has a 28k differential transimpedance gain and a -3dB bandwidth of 140MHz. This typical application is optimized for a 50 Mb/s Non Return to Zero (NRZ) bit stream.

As the system's gain bandwidth product is very high, it is crucial to employ good RF design and printed circuit board layout techniques to prevent the system from becoming unstable.

For more information on this application, please refer to AB 1432.

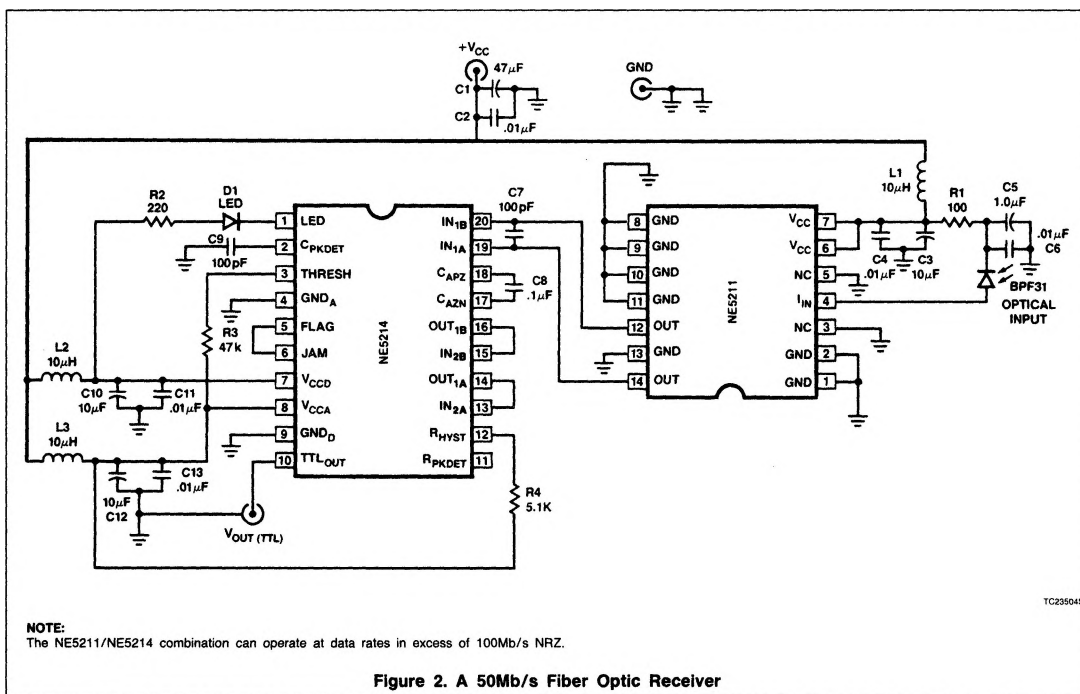


Figure 2. A 50Mb/s Fiber Optic Receiver