



“NexGen 3”™

Low Noise Amplifier Modules for Cryogenic Use

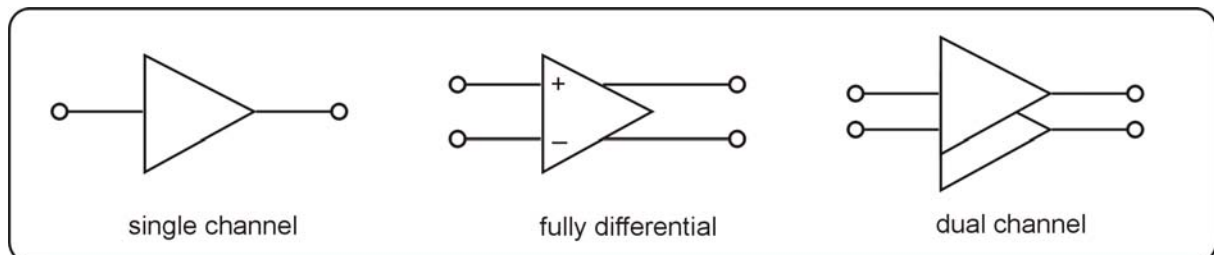


short form datasheet (4 pages)

Features:

- **Very Low Noise:** $\sim 1.3\text{nV}/\sqrt{\text{Hz}}$ ($f = 400\text{kHz}$, $T = 4.2\text{K}$)
- **Small Size:** 50.0mm x 14.2mm x 5.0mm
- **Low Power Consumption:** $<10\text{mW}$ ($T = 4.2\text{K}$)
- **Wide Frequency Range** 5kHz ... 10MHz
- **Wide Temperature Range** 4.2K ... 300K
- **GaAs Technology allows operation in strong magnetic fields**

Versions Available:



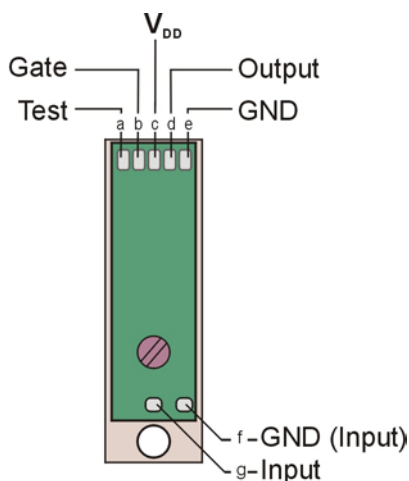
© 2006 Dr. Stefan Stahl	Company Info: Dr. Stefan Stahl Electronics for Science and Research Kellerweg 23, D - 67582 Mettenheim • Germany - all rights reserved -	Internet: stahl-electronics.com email: develop_group@web.de
Document: Datasheet_NexGen_ ShortForm.doc		last revision: 20-June-2006

Description

The NexGen_3 amplifier is a highly sensitive voltage preamplifier module, which is intended for low-temperature, low-noise applications. It is capable of operating in an extremely wide temperature range ($T = 4.2\text{K} \dots 323\text{K}$) and covers a frequency span of $5\text{kHz} \dots 10\text{MHz}$. Since its semiconductor components are based on GaAs (Gallium-Arsenide)-FET technology, it allows operation in strong magnetic fields. These properties, together with a small geometrical outline ($50.0\text{mm} \times 14.2\text{mm} \times 5.0\text{mm}$) and a high input impedance, open up the possibility to use this device as a charge or voltage amplifier, for use with FT-ICR/ Penning Traps or Charge Detectors.

The small size eases also a simple supplementary installation, for upgrading of existing systems. The NexGen_3 series amplifiers are delivered as printboard, mounted on a copper heat sink. Bias- and signal lines can be connected by normal soft-soldering procedures by the user. Other customer specific outlines or vacuum-tight (UHV grade) housings are available on request.

Pinout an External Circuitry



Pinout

- | | |
|---|--|
| a | Test and Calibration input (see text) |
| b | Gate, negative FET-gate supply |
| c | V_{DD} , positive supply voltage |
| d | Output, signal output |
| e | GND, ground for output and supply voltages |
| f | GND, ground reference for input signals |
| g | Input, high impedance input |

fig. 1: Pinout / Pad Connections

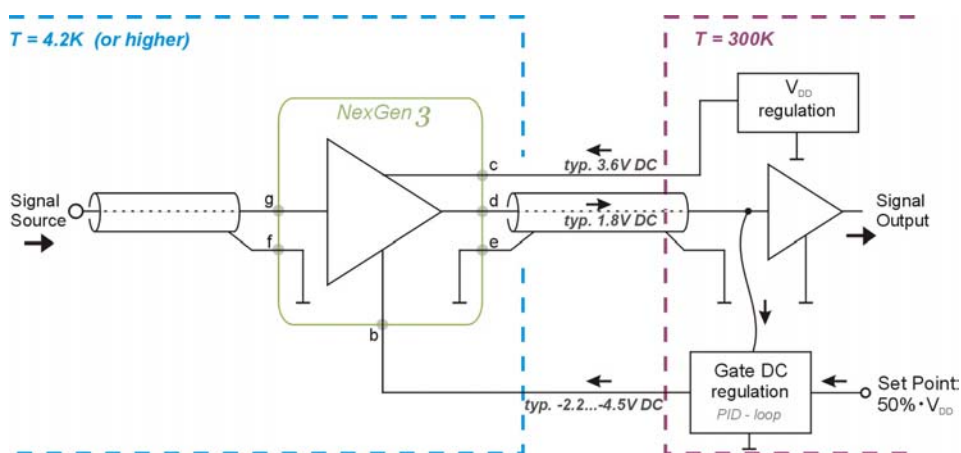


fig. 2: Recommended External Circuitry and Connections to Signal Source

Characteristical Data and Operating Parameters

Parameter	typ. Value	Remarks/Conditions
Freq. Range for $\pm 3\text{dB}$ deviation for $\pm 1\text{dB}$ deviation upper frequency limit, -5dB deviation	5kHz...10MHz 10kHz...5MHz 17MHz	output connected to high impedance load, $V_{DD} > 2.5\text{V}$
Gain Voltage gain @300K Voltage gain @4.2K	$\times 40 \pm 10\%$ $\times 50 \pm 10\%$	$V_{DD} = 3.6\text{V}$ $V_{DD} = 3.6\text{V}$ Amplification at other biasing conditions: see performance curves
Input Impedance DC AC input capacitance	$> 100\text{M}\Omega$ capacitively coupled $1\text{M}\Omega$ vs. GND $15\text{pF} \pm 1.0\text{pF}$	@ 300K
Output Impedance	100Ω	depending on temperature and biasing conditions
Input Noise 300K voltage noise density 4.2K current noise density voltage noise density current noise density	$2.8\text{nV}/\sqrt{\text{Hz}}$ TBD (to be determined) $1.3\text{nV}/\sqrt{\text{Hz}}$ TBD (to be determined)	@ $f = 400\text{kHz}$, $V_{DD} = 3.6\text{V}$ @ $f = 400\text{kHz}$, $V_{DD} = 3.6\text{V}$
Operating voltages 300K V_{DD} , positive supply voltage, Pad (c) Gate Biasing, Pad (b) 4.2K V_{DD} , positive supply voltage, Pad (c) Gate Biasing, Pad (b)	recomm. $+3.6\text{V}$ or $+4.3\text{V}$ (min. $+1.8\text{V}$... max. $+4.7\text{V}$) -4.4V typ. recomm. $+3.6\text{V}$ (min. $+1.8\text{V}$... max. $+4.3\text{V}$) -2.5V typ.	see biasing remark see biasing remark
Supply Currents @ $V_{DD} = 3.6\text{V}$ from V_{DD} from Gate Biasing Pad (b)	$3,2\text{mA}$ @ $T = 300\text{K}$ $1,85\text{mA}$ @ $T = 4.2\text{K}$ $< 100\mu\text{A}$	see detailed graphs
Operating Temperatures	$T = 4.2\text{K} \dots 323\text{K}$ $= -269^\circ\text{C} \dots 50^\circ\text{C}$	
Power Consumption	$< 11\text{mW}$ @ $T = 4.2\text{K} \dots 300\text{K}$	V_{DD} (Pad c) $\leq 3.6\text{V}$ vs. GND
Magnetic Properties	Device consists mostly of non-magnetic materials. spurious amounts of ferromagnetic substances $< 5 \times 10^{-3}\text{gr.}$ possible	For use with FT-ICR cells, it is recommended to locate the device min. 5cm away from the ion trap/FT-ICR cell structure in order to avoid magnetic disturbance
Geometrical Size	$50.0\text{mm} \times 14.2\text{mm} \times 5.0\text{mm}$	
Weight	14 gr.	
Remark: This table represents typical values at low magnetic fields. The behaviour at very high magnetic fields is still under investigation.		

typ. Voltage Noise Density at Liquid Helium Temperature (4.2K)

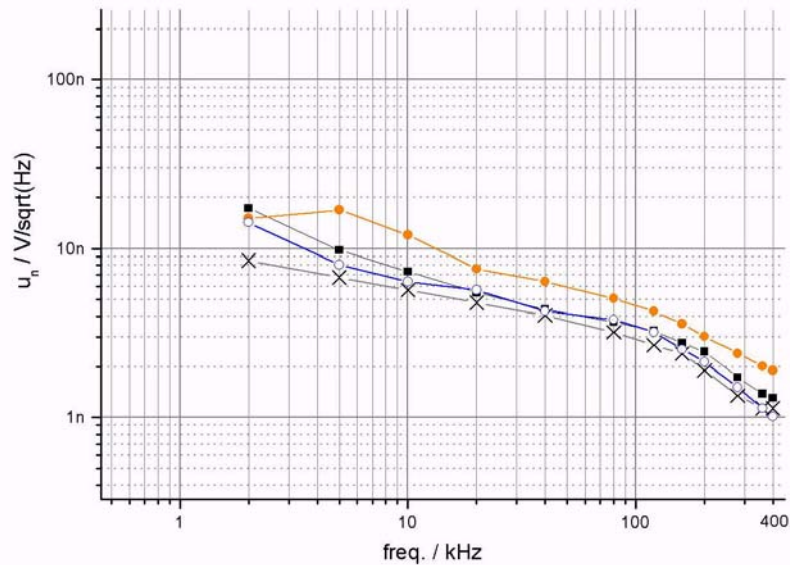


fig. 3: Voltage Noise Density at T = 4.2K

Measurement Parameters:

device under test : NexGen_3 series, KC05c; ser.-# 101002
 FFT-Analysis : Yokogawa SA2400
 Signal Source for Level Ref. : Rohde&Schwarz SMY01
 environmental temperature : T = 4.2K, immersed in liquid Helium

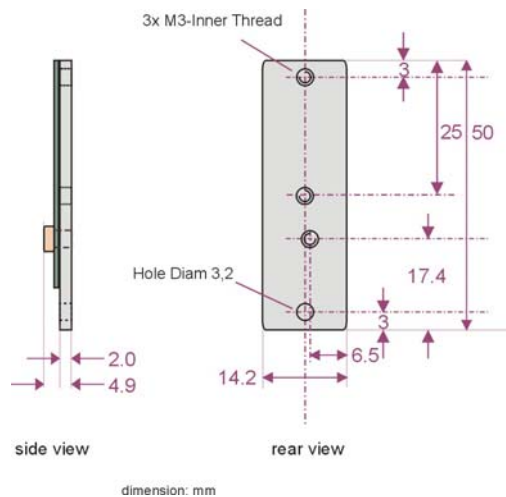
Graph parameters :

X/Y-axis units : kHz, nV/√Hz

Measurement Curves:

○	: U _{Supply} = 1.8V,	I _{Supply} = 1.38mA,	U _{Gate} = -2.0V
X	: U _{Supply} = 2.5V,	I _{Supply} = 1.51mA,	U _{Gate} = -2.2V
●	: U _{Supply} = 3.6V,	I _{Supply} = 1.64mA,	U _{Gate} = -2.45V
●	: U _{Supply} = 4.3V,	I _{Supply} = 1.85mA,	U _{Gate} = -3.1V

Geometrical Outline



Note: Printed Copper Board is mounted with M3 copper screw on copper substrate, which serves as heat sink and thermal coupling to the users heat sink.

© 2006 Dr. Stefan Stahl

- all rights reserved -