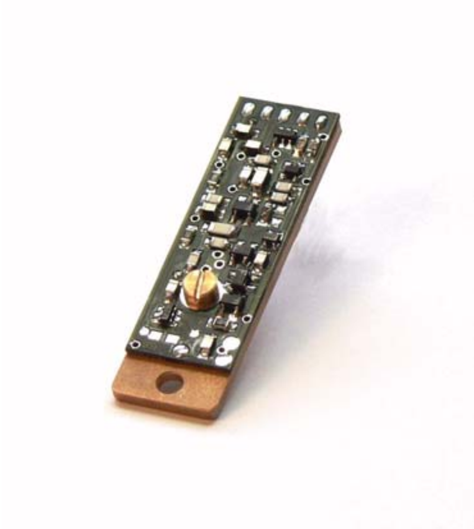
Stahl-Electronics.com

“NexGen 3”™

Low Noise Amplifier Modules for Cryogenic Use

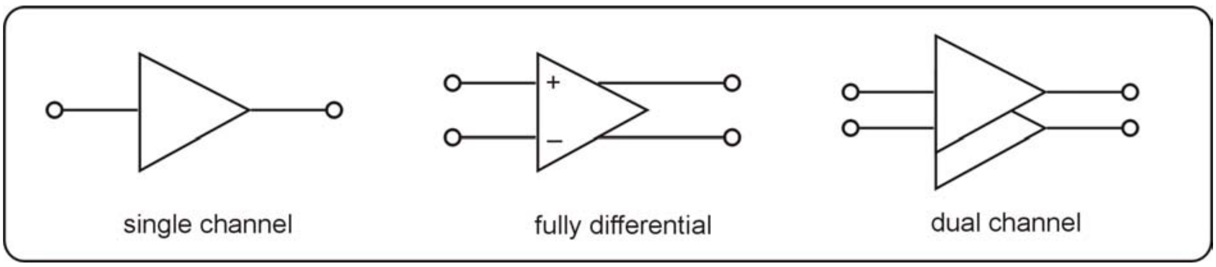


short form datasheet (4 pages)

Features:

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

Versions Available:



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 a extremely wide temperature range (T = 4.2K ... 323K) and covers a frequency span of 5kHz....10MHz. 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 (50.0mm x 14.2mm x 5.0mm) 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

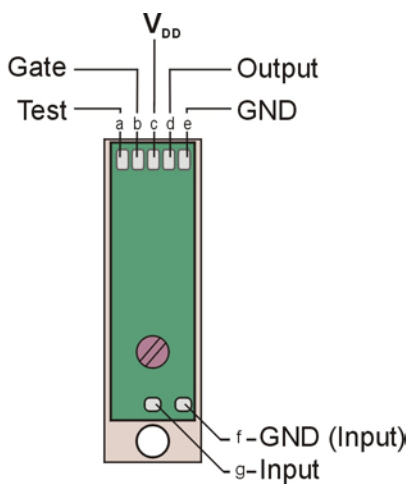


fig. 1: Pinout / Pad Connections

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

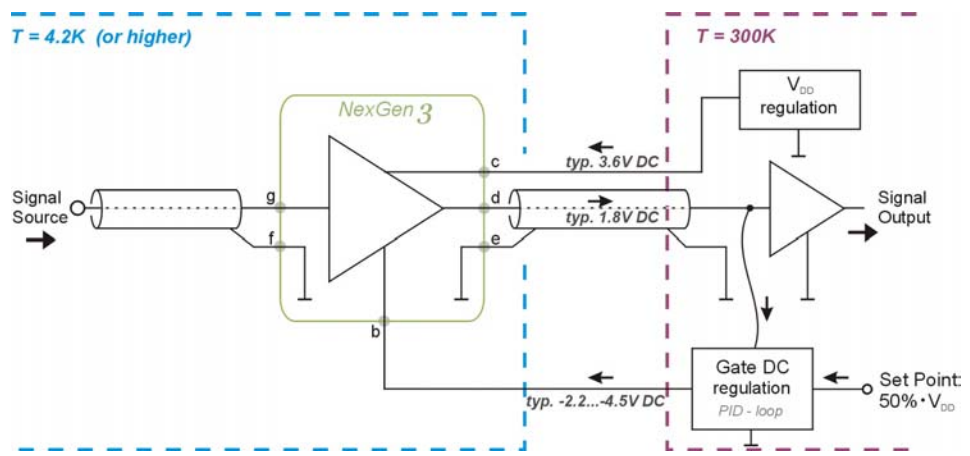


fig. 2: Recommended External Circuitry and Connections to Signal Source

Characteristical Data and Operating Parameters

Parameter	**typ. Value**	**Remarks/Conditions**
Freq. Range for ±3dB deviation for ±1dB deviation upper frequency limit, -5dB deviation	5kHz....10MHz 10kHz....5MHz 17MHz	output connected to high impedance load, V_{DD} > 2.5V
Gain Voltage gain @300K Voltage gain @4.2K	x 40 ± 10% x 50 ± 10%	V_{DD} = 3.6V V_{DD} = 3.6V Amplification at other biasing conditions: see performance curves
Input Impedance DC AC input capacitance	> 100MΩ capacitively coupled 1MΩ vs. GND 15pF ±1.0pF	@ 300K
Output Impedance	100 Ω	depending on temperature and biasing conditions
Input Noise **300K** voltage noise density current noise density **4.2K** voltage noise density current noise density	2.8nV/√Hz TBD (to be determined) 1.3nV/√Hz TBD (to be determined)	@ f = 400kHz, V_{DD} = 3.6V @ f = 400kHz, V_{DD} = 3.6V
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. +3.6V or +4.3V (min. +1.8V ... max. +4.7V) -4.4V typ. recomm. +3.6V (min. +1.8V ... max. +4.3V) -2.5V typ.	see biasing remark see biasing remark
Supply Currents @ V_{DD} = 3.6V from V_{DD} from Gate Biasing Pad (b)	3,2mA @ T = 300K 1,85mA @ T = 4.2K < 100µA	see detailed graphs
Operating Temperatures	T = 4.2K...323K = -269°C...50°C	
Power Consumption	< 11mW @ T = 4.2K ... 300K	V_{DD} (Pad c) ≤ 3.6V vs. GND
Magnetic Properties	Device consists mostly of non-magnetic materials. spurious amounts of ferromagnetic substances < 5 x 10^{-3}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	50.0mm x 14.2mm x 5.0mm	
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)

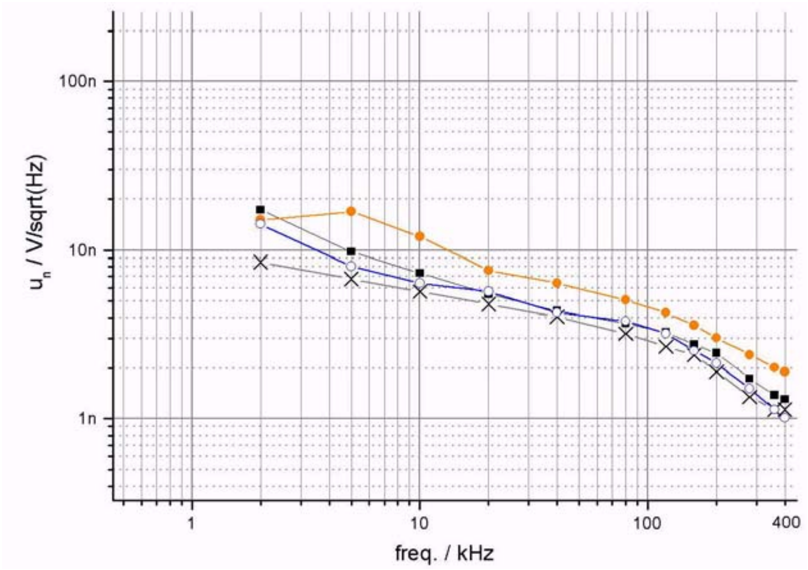


fig. 3: Voltage Noise Density at T = 4.2K

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

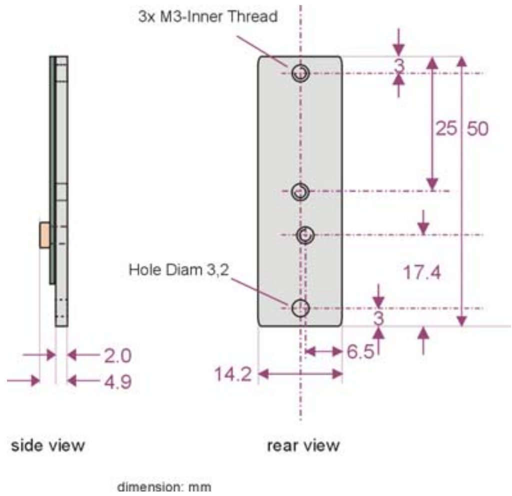
Graph parameters :

X/Y-axis units : kHz, nV/√Hz

Measurement Curves:

o	: 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.