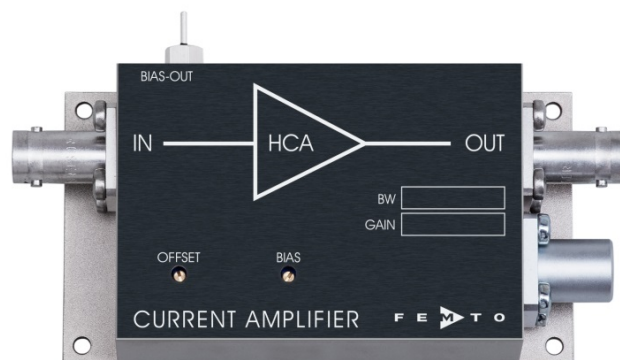


# High-Speed Current Amplifier



<p>Features</p>	<ul style="list-style-type: none"> <li>• <b>Bandwidth DC ... 200 MHz</b></li> <li>• <b>Transimpedance (Gain) <math>2 \times 10^4</math> V/A</b></li> <li>• <b>Suitable for Source Capacitance up to 8 pF</b></li> <li>• <b>Low Equivalent Input Noise Current of 4.9 pA/<math>\sqrt{\text{Hz}}</math></b></li> </ul>																																																																						
<p>Applications</p>	<ul style="list-style-type: none"> <li>• <b>Photodiode and Photomultiplier Amplifier</b></li> <li>• <b>Spectroscopy</b></li> <li>• <b>Charge Amplifier</b></li> <li>• <b>Ionisation Detectors</b></li> <li>• <b>Preamplifier for Lock-Ins, A/D Converters, etc.</b></li> </ul>																																																																						
<p>Specifications</p>	<table border="0"> <tr> <td>Test Conditions</td> <td colspan="2"><math>V_s = \pm 15</math> V, <math>T_a = 25^\circ\text{C}</math></td> </tr> <tr> <td rowspan="2">Gain</td> <td>Transimpedance</td> <td><math>2 \times 10^4</math> V/A (@ 50 <math>\Omega</math> load)</td> </tr> <tr> <td>Gain Accuracy</td> <td><math>\pm 2</math> %</td> </tr> <tr> <td rowspan="5">Frequency Response</td> <td>Lower Cut-Off Frequency</td> <td>DC</td> </tr> <tr> <td rowspan="2">Upper Cut-Off Frequency (- 3 dB)</td> <td>200 MHz</td> <td>(<math>\pm 10</math> %, @ <math>C_{\text{source}}</math> 2 to 4 pF)</td> </tr> <tr> <td>170 MHz</td> <td>(<math>\pm 10</math> %, @ <math>C_{\text{source}}</math> 5 to 8 pF)</td> </tr> <tr> <td>Max. Source Capacitance</td> <td>8 pF</td> <td>(incl. cable, e.g. typical coax cable 1 pF/cm)</td> </tr> <tr> <td rowspan="2">Rise / Fall Time (10 % - 90 %)</td> <td>1.9 ns</td> <td>(@ <math>C_{\text{source}}</math> 2 to 4 pF)</td> </tr> <tr> <td>2.2 ns</td> <td>(@ <math>C_{\text{source}}</math> 5 to 8 pF)</td> </tr> <tr> <td>Gain Flatness</td> <td colspan="2"><math>\pm 0.3</math> dB</td> </tr> <tr> <td rowspan="9">Input</td> <td>Equ. Input Noise Current</td> <td>4.9 pA/<math>\sqrt{\text{Hz}}</math> (@ 10 MHz)</td> </tr> <tr> <td>Equ. Input Noise Voltage</td> <td>0.9 nV/<math>\sqrt{\text{Hz}}</math> (@ 10 MHz)</td> </tr> <tr> <td>Equ. Integrated Noise</td> <td>1.0 <math>\mu\text{A}</math> peak-peak</td> </tr> <tr> <td>Input Bias Current</td> <td>12 <math>\mu\text{A}</math> typ.</td> </tr> <tr> <td>Input Bias Current Drift</td> <td>3 nA / <math>^\circ\text{C}</math></td> </tr> <tr> <td>Offset Current Compensation</td> <td colspan="2"><math>\pm 100</math> <math>\mu\text{A}</math> adjustable by offset trimpot</td> </tr> <tr> <td>Input Current Range</td> <td colspan="2"><math>\pm 60</math> <math>\mu\text{A}</math> (for linear amplification)</td> </tr> <tr> <td>Input Offset Voltage</td> <td colspan="2">&lt; 1 mV</td> </tr> <tr> <td>DC Input Impedance</td> <td colspan="2">56 <math>\Omega</math> (virtual) // 5 pF</td> </tr> <tr> <td rowspan="3">Output</td> <td>Output Voltage Range</td> <td><math>\pm 1.2</math> V (@ 50 <math>\Omega</math> load)</td> </tr> <tr> <td></td> <td colspan="2">for linear operation and low harmonic distortion</td> </tr> <tr> <td>Max. Output Voltage Range</td> <td colspan="2"><math>\pm 1.7</math> V (@ 50 <math>\Omega</math> load)</td> </tr> <tr> <td>Output Impedance</td> <td colspan="2">50 <math>\Omega</math> (terminate with 50 <math>\Omega</math> load for best performance)</td> </tr> <tr> <td rowspan="2">Bias Output</td> <td>Bias Output Voltage Range</td> <td colspan="2"><math>\pm 12</math> V, adjustable by bias trimpot</td> </tr> <tr> <td>Bias Output Impedance</td> <td colspan="2">10 k<math>\Omega</math> // 1 <math>\mu\text{F}</math></td> </tr> </table>		Test Conditions	$V_s = \pm 15$ V, $T_a = 25^\circ\text{C}$		Gain	Transimpedance	$2 \times 10^4$ V/A (@ 50 $\Omega$ load)	Gain Accuracy	$\pm 2$ %	Frequency Response	Lower Cut-Off Frequency	DC	Upper Cut-Off Frequency (- 3 dB)	200 MHz	( $\pm 10$ %, @ $C_{\text{source}}$ 2 to 4 pF)	170 MHz	( $\pm 10$ %, @ $C_{\text{source}}$ 5 to 8 pF)	Max. Source Capacitance	8 pF	(incl. cable, e.g. typical coax cable 1 pF/cm)	Rise / Fall Time (10 % - 90 %)	1.9 ns	(@ $C_{\text{source}}$ 2 to 4 pF)	2.2 ns	(@ $C_{\text{source}}$ 5 to 8 pF)	Gain Flatness	$\pm 0.3$ dB		Input	Equ. Input Noise Current	4.9 pA/ $\sqrt{\text{Hz}}$ (@ 10 MHz)	Equ. Input Noise Voltage	0.9 nV/ $\sqrt{\text{Hz}}$ (@ 10 MHz)	Equ. Integrated Noise	1.0 $\mu\text{A}$ peak-peak	Input Bias Current	12 $\mu\text{A}$ typ.	Input Bias Current Drift	3 nA / $^\circ\text{C}$	Offset Current Compensation	$\pm 100$ $\mu\text{A}$ adjustable by offset trimpot		Input Current Range	$\pm 60$ $\mu\text{A}$ (for linear amplification)		Input Offset Voltage	< 1 mV		DC Input Impedance	56 $\Omega$ (virtual) // 5 pF		Output	Output Voltage Range	$\pm 1.2$ V (@ 50 $\Omega$ load)		for linear operation and low harmonic distortion		Max. Output Voltage Range	$\pm 1.7$ V (@ 50 $\Omega$ load)		Output Impedance	50 $\Omega$ (terminate with 50 $\Omega$ load for best performance)		Bias Output	Bias Output Voltage Range	$\pm 12$ V, adjustable by bias trimpot		Bias Output Impedance	10 k $\Omega$ // 1 $\mu\text{F}$	
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High-Speed Current Amplifier

Specifications (continued)

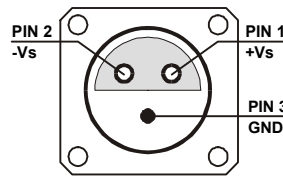
Power Supply	Supply Voltage	$\pm 15\text{ V}$
	Supply Current	$\pm 50\text{ mA typ.}$ (depends on operating conditions, recommended power supply capability minimum $\pm 150\text{ mA}$ )
Case	Weight	210 g (0.5 lbs)
	Material	AlMg4.5Mn, nickel-plated
Temperature Range	Storage Temperature	$-40 \dots +100\text{ }^\circ\text{C}$
	Operating Temperature	$0 \dots +60\text{ }^\circ\text{C}$

Absolute Maximum Ratings

Input Voltage	$\pm 5\text{ V}$
Power Supply Voltage	$\pm 22\text{ V}$

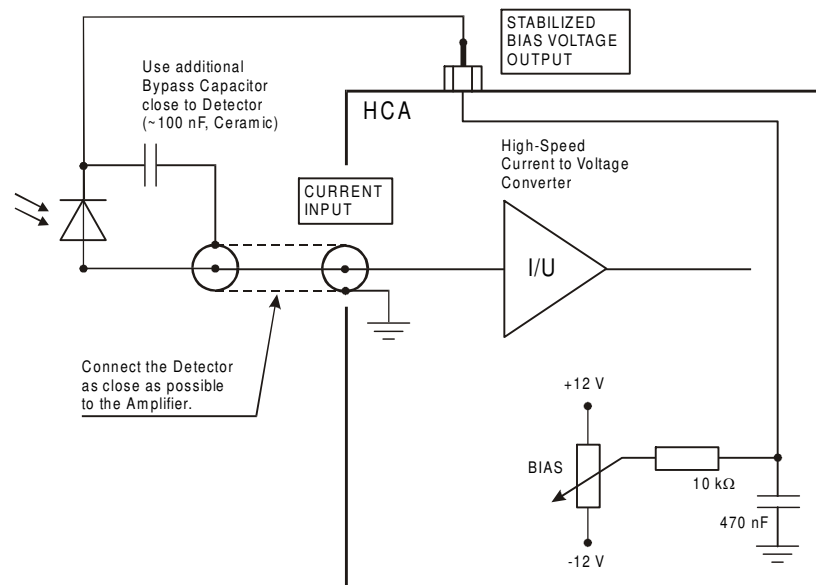
Connectors

Input	BNC
Output	BNC
Power Supply	LEMO series 1S, 3-pin fixed socket
	Pin 1: +15V
	Pin 2: -15V
	Pin 3: GND



Application Diagrams

Photo Detector Biasing in Photoconductive Mode:  
Best choice for high speed applications and optimum signal to noise performance.



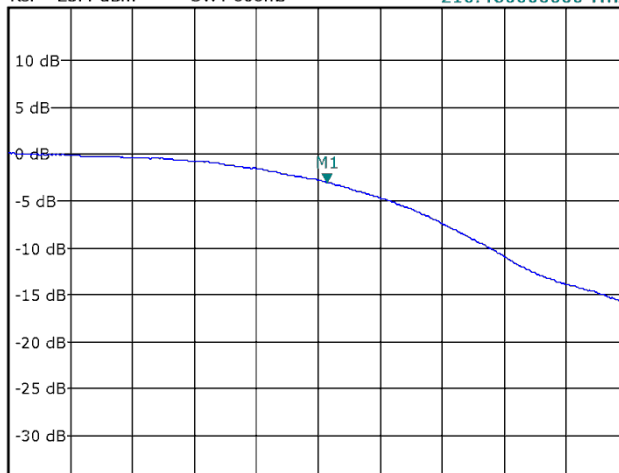
AZ01-0201-20

# High-Speed Current Amplifier

Typical Performance Characteristics

## Frequency Response

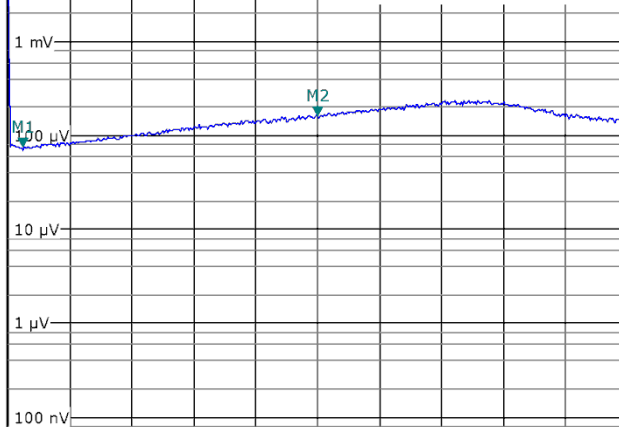
Offs 5.1 dB      RBW 3 MHz  
 Att 0 dB      \* VBW 1 kHz      M1[1]      -3.00 dB  
 Ref -23.4 dBm      SWT 660ms      210.48000000 MHz



Start 10.0 MHz      Stop 400.0 MHz

## Noise Spectrum

\* RBW 1 MHz  
 Att 0 dB      \* VBW 1 kHz      Noise1      96.560999 nV/√Hz  
 Ref 7.1 mV      SWT 800ms      10.00000000 MHz  
 Noise2      208.012239 nV/√Hz  
 200.00000000 MHz



Start 0.0 Hz      Stop 400.0 MHz

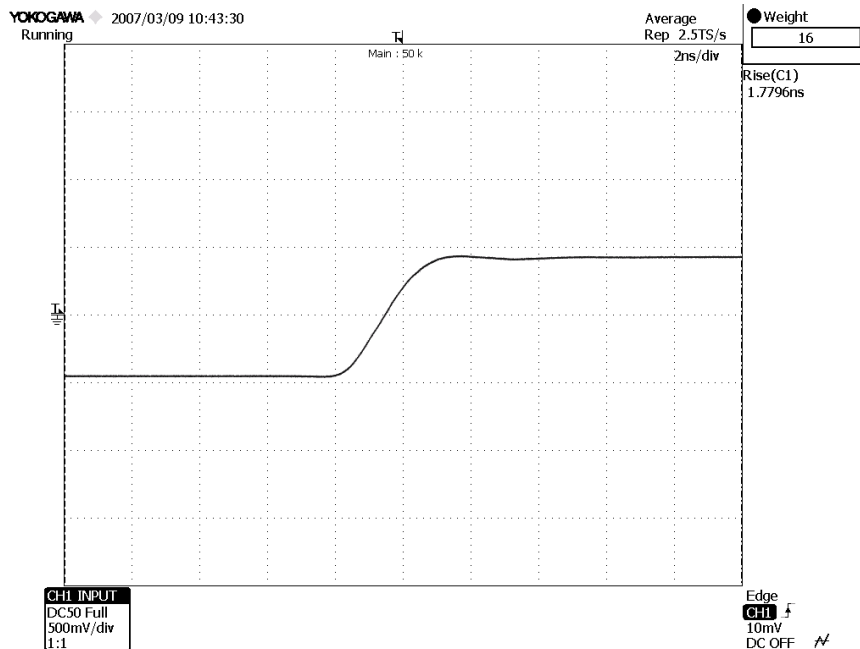
Note: Spectral noise data is measured at the amplifier output with open but shielded input. To determine the spectral input noise divide the measured output noise by the amplifier gain of  $2 \times 10^4$  V/A, i.e.:

Marker	Frequency	Output Noise	Resulting Input Noise
1	10 MHz	97 nV/√Hz	4.9 pA/√Hz
2	200 MHz	208 nV/√Hz	10.4 pA/√Hz

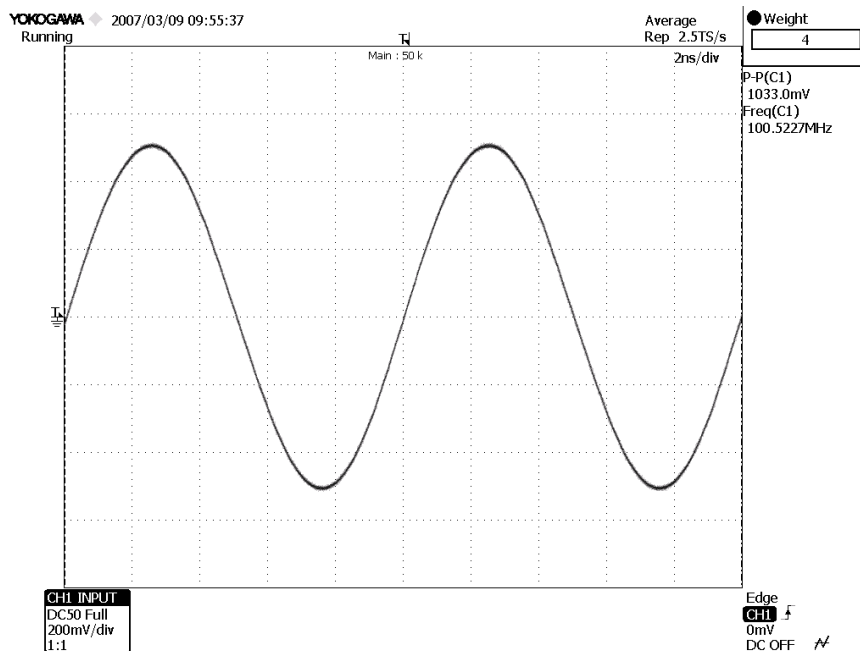
# High-Speed Current Amplifier

Typical Performance Characteristics (continued)

Pulse Response to Square Wave Input Signal (with 16 times averaging)



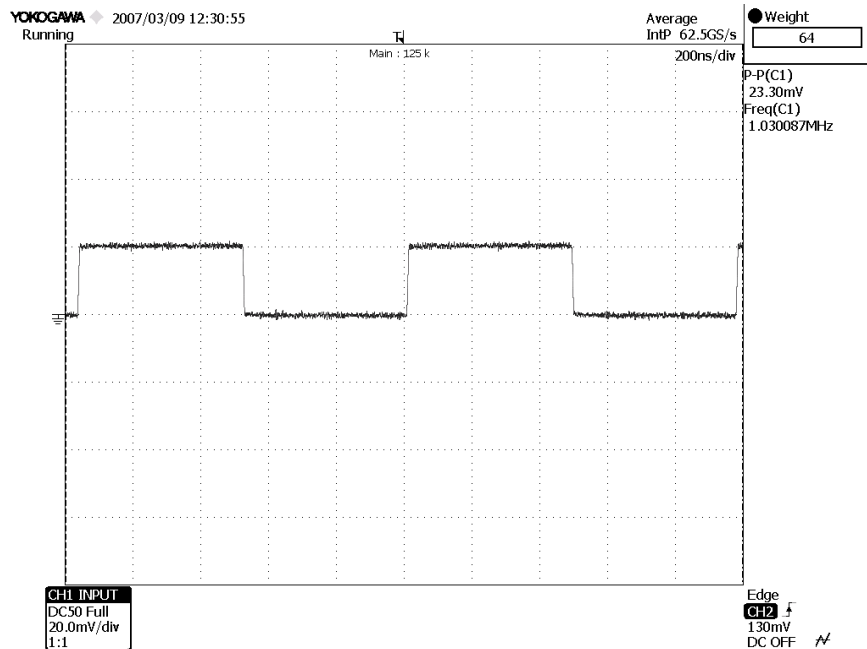
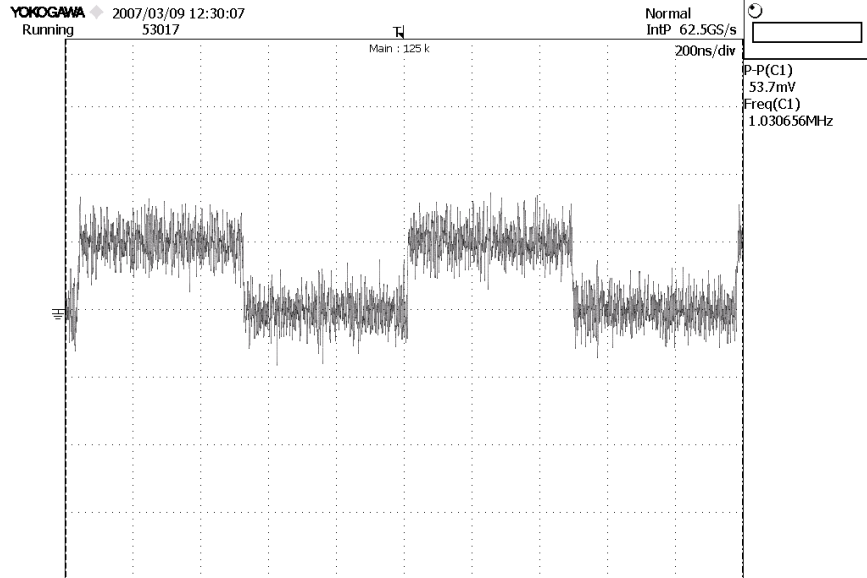
Large Signal Response output signal for 100 MHz, 50  $\mu$ A peak-peak input signal (with 4 times averaging)



# High-Speed Current Amplifier

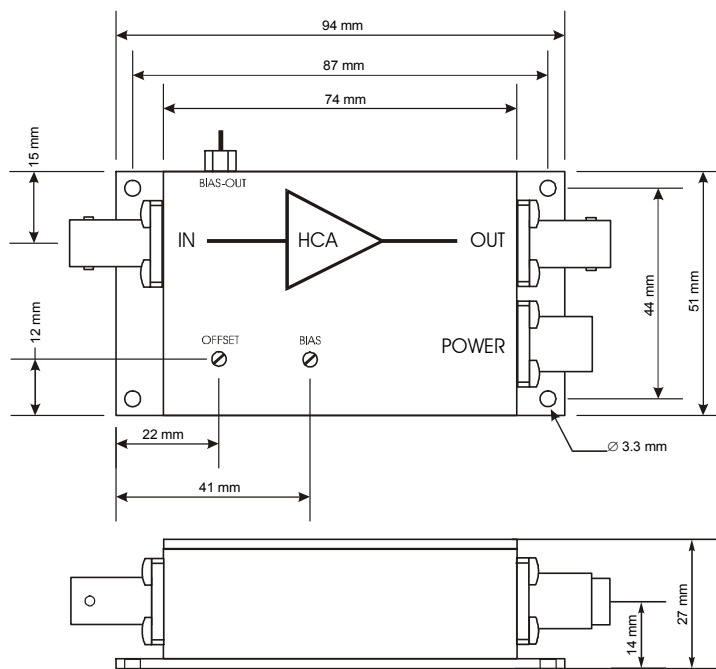
Typical Performance Characteristics (continued)

Small Signal Response  
output signal for 1 MHz, 1  $\mu$ A peak-peak square wave input signal  
(without (top) and with 64 times averaging (bottom))



High-Speed Current Amplifier

Dimensions



DZ01-0201-22

FEMTO Messtechnik GmbH  
 Klosterstr. 64  
 10179 Berlin · Germany  
 Phone: +49 30 280 4711-0  
 Fax: +49 30 280 4711-11  
 Email: info@femto.de  
 www.femto.de

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