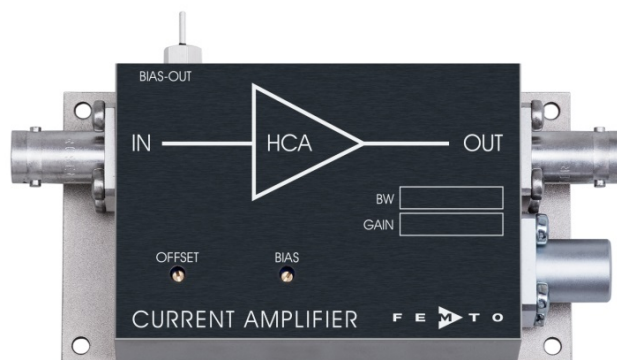


# High-Speed Current Amplifier



<p>Features</p>	<ul style="list-style-type: none"> <li>• <b>Bandwidth DC ... 100 MHz</b></li> <li>• <b>Transimpedance (Gain) <math>5 \times 10^4</math> V/A</b></li> <li>• <b>Suitable for High Source Capacitance up to 20 pF</b></li> <li>• <b>Low Equivalent Input Noise Current of <math>3.8 \text{ pA}/\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 \text{ V}</math>, <math>T_a = 25^\circ\text{C}</math></td> </tr> <tr> <td rowspan="2">Gain</td> <td>Transimpedance</td> <td><math>5 \times 10^4 \text{ V/A}</math> (@ 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>100 MHz</td> <td>(<math>\pm 10 \%</math>, @ <math>C_{\text{source}}</math> 2 to 10 pF)</td> </tr> <tr> <td>80 MHz</td> <td>(<math>\pm 10 \%</math>, @ <math>C_{\text{source}}</math> 11 to 20 pF)</td> </tr> <tr> <td>Max. Source Capacitance</td> <td>20 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>3.4 ns</td> <td>(@ <math>C_{\text{source}}</math> 2 to 10 pF)</td> </tr> <tr> <td>4.0 ns</td> <td>(@ <math>C_{\text{source}}</math> 11 to 20 pF)</td> </tr> <tr> <td>Gain Flatness</td> <td colspan="2"><math>\pm 0.3 \text{ dB}</math></td> </tr> <tr> <td rowspan="10">Input</td> <td>Equ. Input Noise Current</td> <td><math>3.8 \text{ pA}/\sqrt{\text{Hz}}</math> (@ 10 MHz)</td> </tr> <tr> <td>Equ. Input Noise Voltage</td> <td><math>0.9 \text{ nV}/\sqrt{\text{Hz}}</math> (@ 10 MHz)</td> </tr> <tr> <td>Equ. Integrated Noise</td> <td colspan="2">0.6 <math>\mu\text{A}</math> peak-peak</td> </tr> <tr> <td>Input Bias Current</td> <td colspan="2">12 <math>\mu\text{A}</math> typ.</td> </tr> <tr> <td>Input Bias Current Drift</td> <td colspan="2">3 nA / <math>^\circ\text{C}</math></td> </tr> <tr> <td>Offset Current Compensation</td> <td colspan="2"><math>\pm 40 \mu\text{A}</math> adjustable by offset trimpot</td> </tr> <tr> <td>Input Current Range</td> <td colspan="2"><math>\pm 30 \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 1.5 \text{ V}</math> (@ 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><math>\pm 1.7 \text{ V}</math> (@ 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 \text{ V}</math>, 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	$V_s = \pm 15 \text{ V}$ , $T_a = 25^\circ\text{C}$		Gain	Transimpedance	$5 \times 10^4 \text{ V/A}$ (@ 50 $\Omega$ load)	Gain Accuracy	$\pm 2 \%$	Frequency Response	Lower Cut-Off Frequency	DC	Upper Cut-Off Frequency (- 3 dB)	100 MHz	( $\pm 10 \%$ , @ $C_{\text{source}}$ 2 to 10 pF)	80 MHz	( $\pm 10 \%$ , @ $C_{\text{source}}$ 11 to 20 pF)	Max. Source Capacitance	20 pF	(incl. cable, e.g. typical coax cable 1 pF/cm)	Rise / Fall Time (10 % - 90 %)	3.4 ns	(@ $C_{\text{source}}$ 2 to 10 pF)	4.0 ns	(@ $C_{\text{source}}$ 11 to 20 pF)	Gain Flatness	$\pm 0.3 \text{ dB}$		Input	Equ. Input Noise Current	$3.8 \text{ pA}/\sqrt{\text{Hz}}$ (@ 10 MHz)	Equ. Input Noise Voltage	$0.9 \text{ nV}/\sqrt{\text{Hz}}$ (@ 10 MHz)	Equ. Integrated Noise	0.6 $\mu\text{A}$ peak-peak		Input Bias Current	12 $\mu\text{A}$ typ.		Input Bias Current Drift	3 nA / $^\circ\text{C}$		Offset Current Compensation	$\pm 40 \mu\text{A}$ adjustable by offset trimpot		Input Current Range	$\pm 30 \mu\text{A}$ (for linear amplification)		Input Offset Voltage	< 1 mV		DC Input Impedance	56 $\Omega$ (virtual) // 5 pF		Output	Output Voltage Range	$\pm 1.5 \text{ V}$ (@ 50 $\Omega$ load)		for linear operation and low harmonic distortion		Max. Output Voltage Range	$\pm 1.7 \text{ V}$ (@ 50 $\Omega$ load)	Output Impedance	50 $\Omega$ (terminate with 50 $\Omega$ load for best performance)		Bias Output	Bias Output Voltage Range	$\pm 12 \text{ V}$ , adjustable by bias trimpot		Bias Output Impedance	10 k $\Omega$ // 1 $\mu\text{F}$	
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High-Speed Current Amplifier

Specifications (continued)

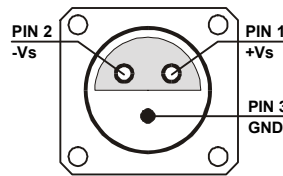
Power Supply	Supply Voltage	$\pm 15\text{ V}$
	Supply Current	$\pm 50\text{ mA typ.}$ (depends on operating conditions, recommended power supply capability minimum $\pm 150\text{ mA}$ )
Case	Weight	210 g (0.5 lbs)
	Material	AlMg4.5Mn, nickel-plated
Temperature Range	Storage Temperature	$-40 \dots +100\text{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

Absolute Maximum Ratings

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

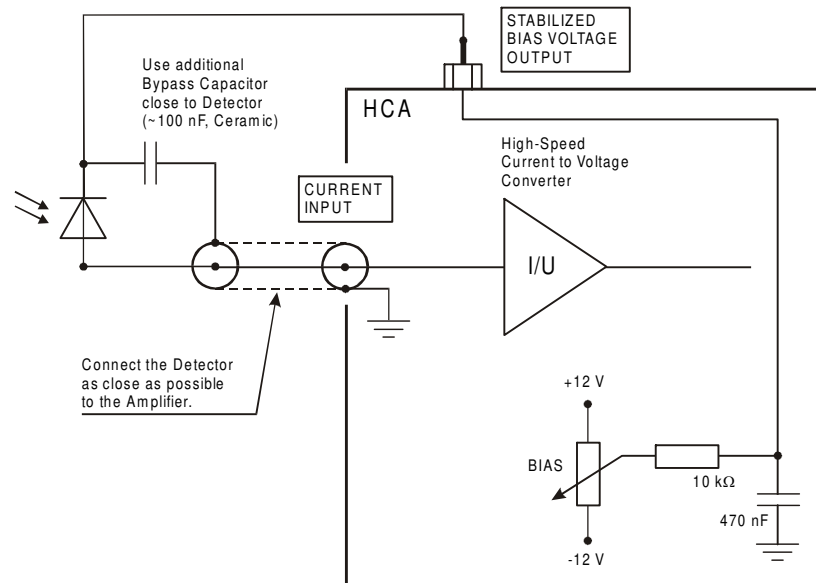
Connectors

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



Application Diagrams

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



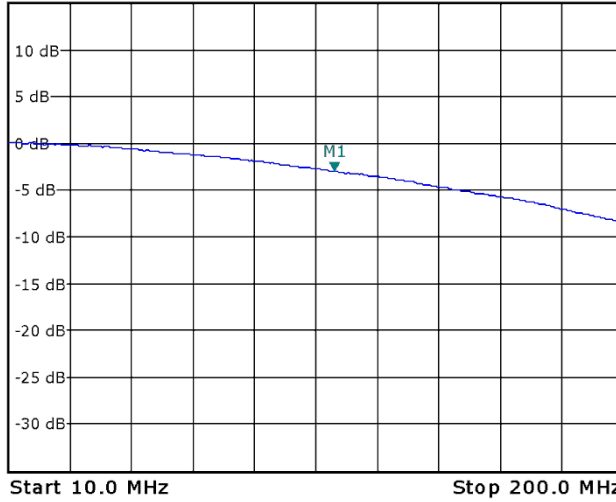
AZ01-0201-20

# High-Speed Current Amplifier

Typical Performance Characteristics

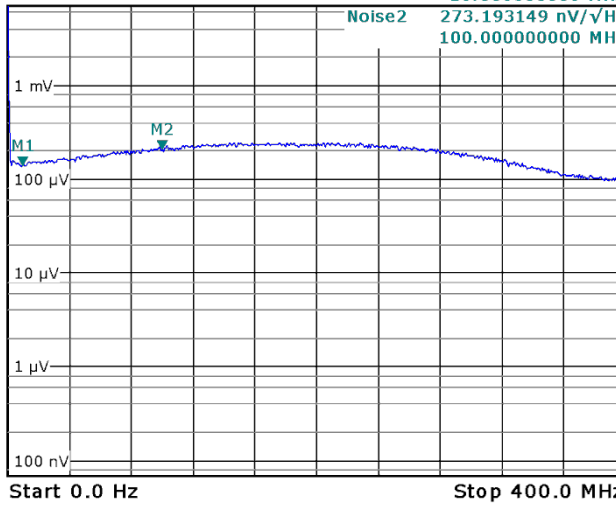
## Frequency Response

Offs 3.3 dB      RBW 3 MHz  
 Att 0 dB      \* VBW 1 kHz      M1[1]      -2.94 dB  
 Ref -26.7 dBm      SWT 320ms      110.640000000 MHz



## Noise Spectrum

\* RBW 1 MHz  
 Att 0 dB      \* VBW 1 kHz      Noise1      189.508338 nV/√Hz  
 Ref 7.1 mV      SWT 800ms      10.000000000 MHz  
 Noise2      273.193149 nV/√Hz  
 100.000000000 MHz



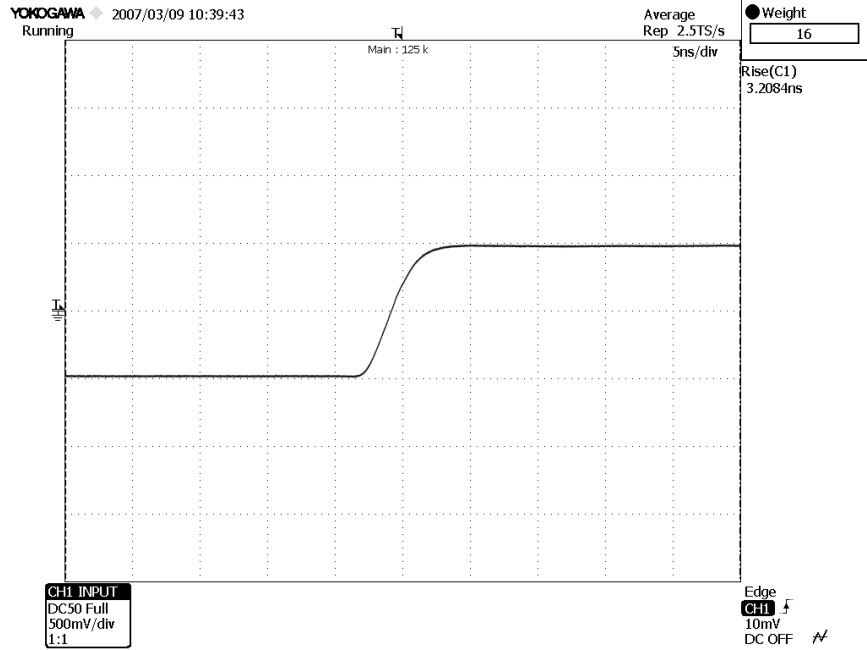
Note: Spectral noise data is measured at the amplifier output with open but shielded input. To determine the spectral input noise divide the measured output noise by the amplifier gain of  $5 \times 10^4$  V/A, i.e.:

Marker	Frequency	Output Noise	Resulting Input Noise
1	10 MHz	190 nV/√Hz	3.8 pA/√Hz
2	100 MHz	273 nV/√Hz	5.5 pA/√Hz

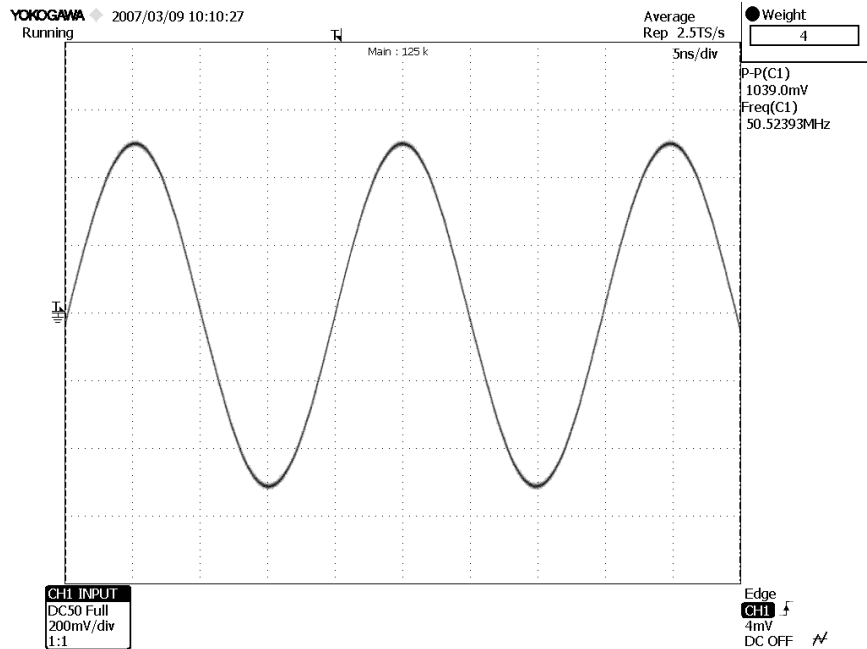
# High-Speed Current Amplifier

Typical Performance Characteristics (continued)

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



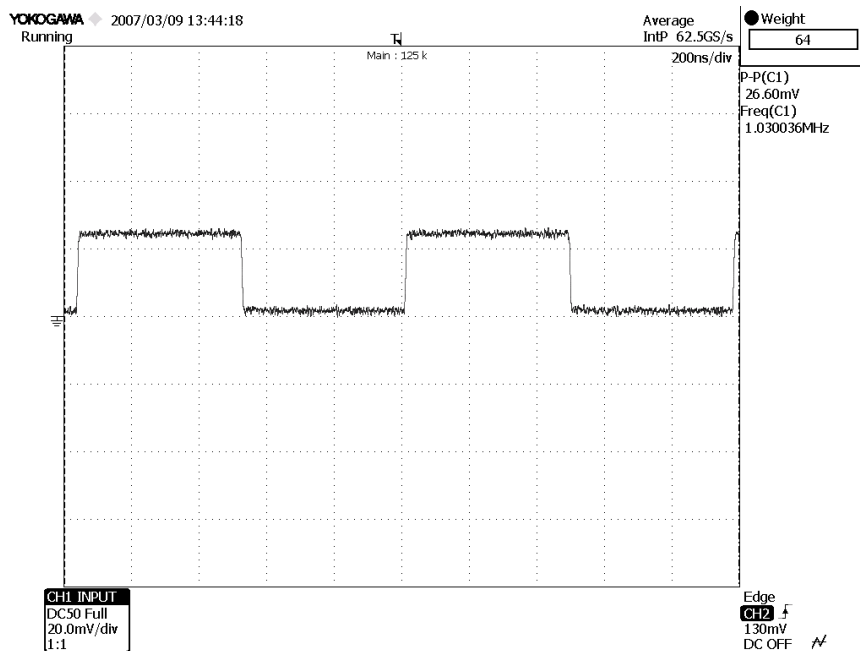
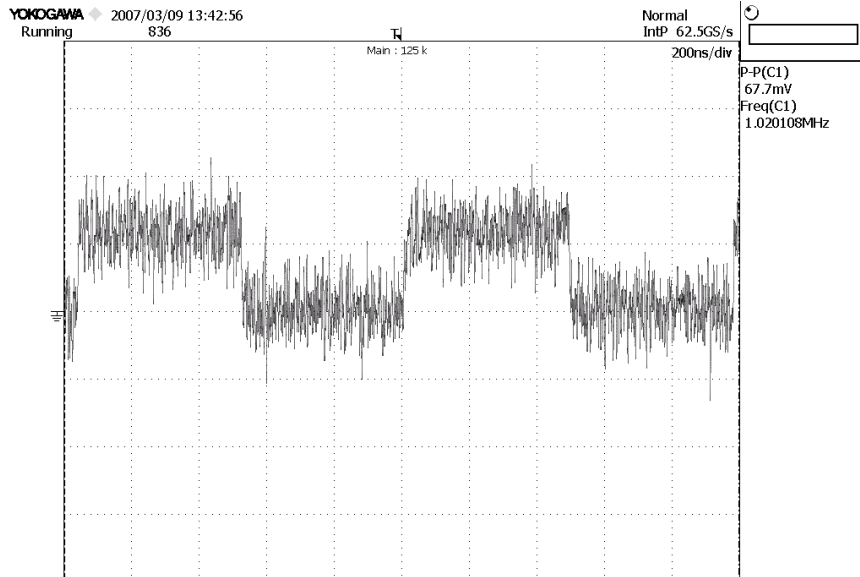
Large Signal Response output signal for 50 MHz, 20  $\mu$ A peak-peak input signal (with 4 times averaging)



# High-Speed Current Amplifier

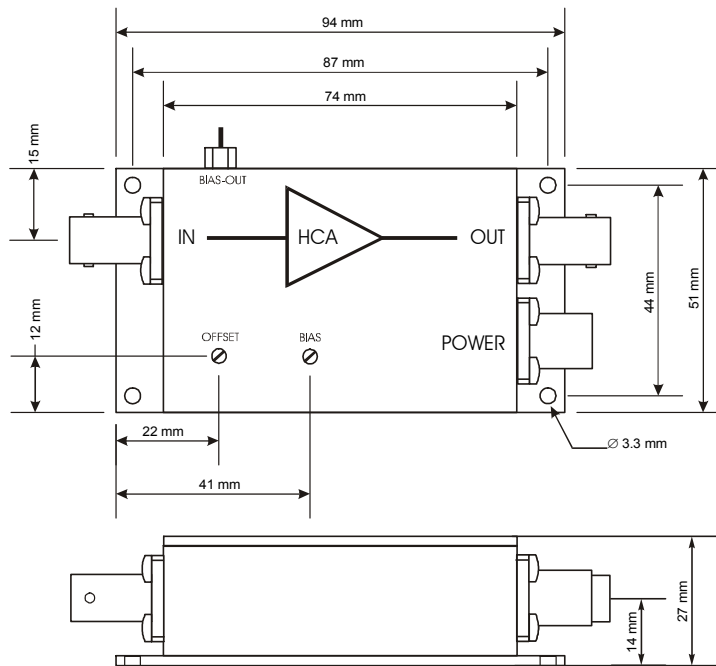
Typical Performance Characteristics (continued)

Small Signal Response  
output signal for 1 MHz, 500 nA peak-peak square wave input signal (without (top) and with 64 times averaging (bottom))



High-Speed Current Amplifier

Dimensions



DZ01-0201-22

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