

TA1000B-10/-50/-100/-200 Fast Pulse / Timing Preamplifier x10/x50/x100/x200, very low noise, DC coupled

FEATURES

- Small signal bandwidth DC ... 1GHz (x50 model)
- Voltage gain 20dB (x10), 34dB (x50), 40dB (x100) and 46dB (x200)
- DC coupling
- Closed loop OP-Amp design
- Very low noise
- High output drive
- Single supply operation / internally generated bipolar supply / internal supply regulation
- Bandwidth limited (BWL) option available for further improved noise performance

APPLICATIONS

- Pre-amp for ultra fast detectors (MCP, PMT, ...)
- Oscilloscope and transient recorder pre-amp
- High precision Time-of-Flight
- Photon-/Ion- counting
- Wideband signal processing

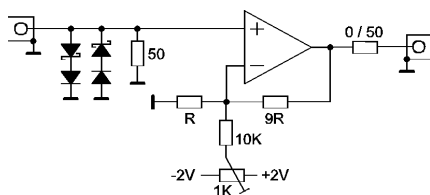


DESCRIPTION

The TA1000B-x models are fast, very low noise pulse pre-amplifiers with a small signal bandwidth of 400MHz ... 1.0 GHz depending on the model.

Each model is available with a bandwidth limited (BWL) option which further reduces the noise floor.

A unique feature for such high speed amplifiers is the DC coupling. DC coupling avoids count rate effects due to non DC balanced pulse trains and the corresponding charging of coupling capacitors.



TA1000B-10 simplified schematic

SPECIFICATIONS

Voltage gain:	TA1000B-10:	20 dB / x10
	TA1000B-50:	34 dB / x50
	TA1000B-100:	40 dB / x100
	TA1000B-200:	46 dB / x200
		non-inverting

Input: BNC, 50 Ohm, DC coupled

Outputs: BNC, low impedance, DC coupled
50Ω output option available
 $V_{OUT} = +/- 1.3V$ max.
 $I_{OUT} = +/- 150mA$ max.

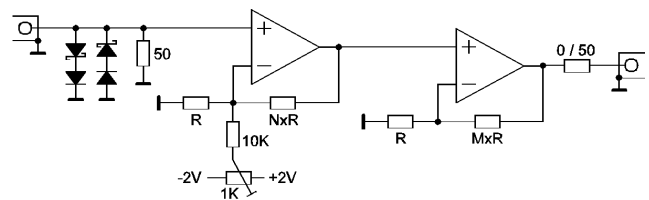
Small signal bandwidth:	($V_{OUT} = 200mV_{RMS}$)
TA1000B-10 BWL:	170 MHz
TA1000B-50 BWL:	245 MHz
TA1000B-100 BWL:	245 MHz
TA1000B-200 BWL:	110 MHz

TA1000B-10:	710 MHz
TA1000B-50:	1000 MHz
TA1000B-100:	950 MHz
TA1000B-200:	400 MHz

Slew rate:	(2V step)
TA1000B-10:	1600 V/μs
TA1000B-10 BWL:	530 V/μs

Input offset voltage: (adjustable) +/- 1.5 mV max.
+/- 2.0 μV/°C typ.

Input referred broadband noise:	
TA1000B-10 BWL;	30.2 μV _{rms} 124 μV _{p-p}
TA1000B-50 BWL;	36.6 μV _{rms} 509 μV _{p-p}
TA1000B-100 BWL;	34.2 μV _{rms} 318 μV _{p-p}
TA1000B-200 BWL;	23.1 μV _{rms} 223 μV _{p-p}
TA1000B-10;	51.2 μV _{rms} 224 μV _{p-p}
TA1000B-50;	57.8 μV _{rms} 541 μV _{p-p}
TA1000B-100;	55.9 μV _{rms} 542 μV _{p-p}
TA1000B-200;	31.2 μV _{rms} 331 μV _{p-p}



TA1000B-50 / -100 / -200 simplified schematic

TA2000-X 02112016

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Material:

Case: extruded aluminium sheath
Al Mg Si 0.5
Lid: die cast, GD-Al Si 12
Size: 65/101 x 60 x 35 mm
Weight: 126 g

Power Requirements:

Connector: 2.1 mm center pin
Supply Voltage: nominal +12V
voltage range +10 ... +18V
Supply Power: 2.5W
False polarity protection

Absolute maximum ratings:

Supply: 25V (100ms max.)
Signal input: +/- 1.8V, +/- 140mA
ESD rating: 2000V HBM, 200V MM

Accessories:

- External wall power supply (included)
- L-clips (AB-WL) for wall-/screw -mounting (optional)

Available Options:

- 50 Ω output impedance
- BWL – bandwidth limited
- Input/Output AC coupling

Type	Nominal Gain [V/V]	Nominal Gain [dB]	Small Signal Bandwidth (-3dB)	Gain Flatness	Peaking (100ps Rise Time Input Pulse)	Input Referred Broadband Noise (DC ... 12.5GHz)		Input Referred LF Noise (20Hz ... 1MHz)
						(3) (4)	(4)	
			(0) (1)	(0) (1)	(0) (2)	(3) (4)	(4)	(5)
TA1000B-10	10	20dB	710MHz	0.00dB	6%	51.2 μ V _{rms}	0.224mV _{p-p}	0.3 μ V _{rms}
TA1000B-10 BWL ⁽⁶⁾	10	20dB	170MHz	0.00dB	0%	30.2 μ V _{rms}	0.124mV _{p-p}	
TA1000B-50	50	34dB	1000MHz	0.22dB	9%	57.8 μ V _{rms}	0.541mV _{p-p}	0.5 μ V _{rms}
TA1000B-50 BWL ⁽⁶⁾	50	34dB	245MHz	0.00dB	0%	36.6 μ V _{rms}	0.509mV _{p-p}	
TA1000B-100	100	40dB	950MHz	0.12dB	8%	55.9 μ V _{rms}	0.542mV _{p-p}	12.3 μ V _{rms}
TA1000B-100 BWL ⁽⁶⁾	100	40dB	245MHz	0.00dB	0%	34.2 μ V _{rms}	0.318mV _{p-p}	
TA1000B-200	200	46dB	400MHz	0.00dB	0%	31.2 μ V _{rms}	0.331mV _{p-p}	13.6 μ V _{rms}
TA1000B-200 BWL ⁽⁶⁾	200	46dB	110MHz	0.00dB	0%	23.1 μ V _{rms}	0.223mV _{p-p}	

TA1000B-x Comparison chart

(0) Simulation Results

(1) Signal input: sine wave = 200mV_{eff} / "nominal Gain"

(2) Output Pulse Height approx. 200mV_{p-p}, Input Rise Time 100ps

(3) defined as $RMS\Delta = \sigma$ = standard deviation, ref. scope pictures of output noise voltages below

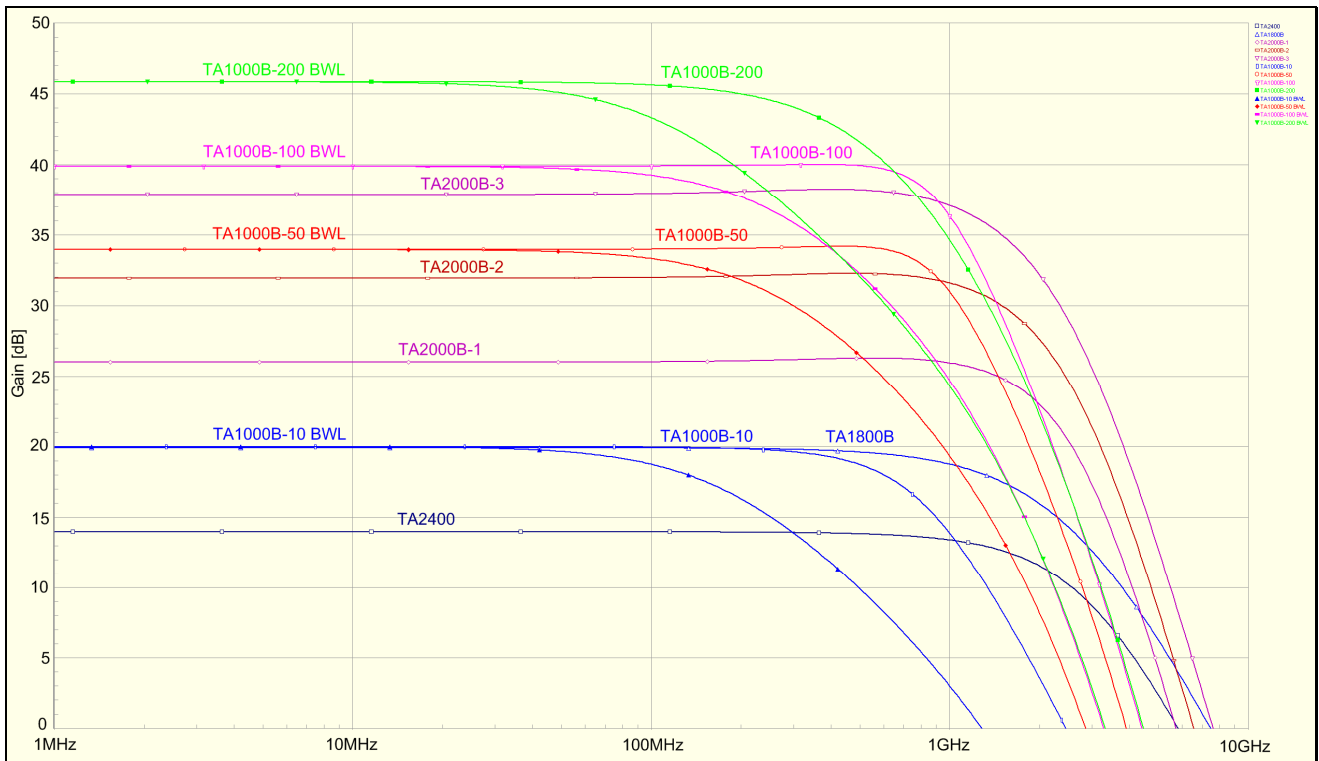
(4) in 40 minutes accumulated with a 12.5GHz sampling head, ref. scope pictures of output noise voltages below

(5) measured with a HP3455A True RMS Voltmeter, this is mostly the 1/f noise

(6) BWL = Bandwidth limited option (with improved noise performance)

WARNING: The amplifiers have no thermal shutdown. Thus, be careful when connecting the output to loads less than 50 Ohms (do not shorten the output!).

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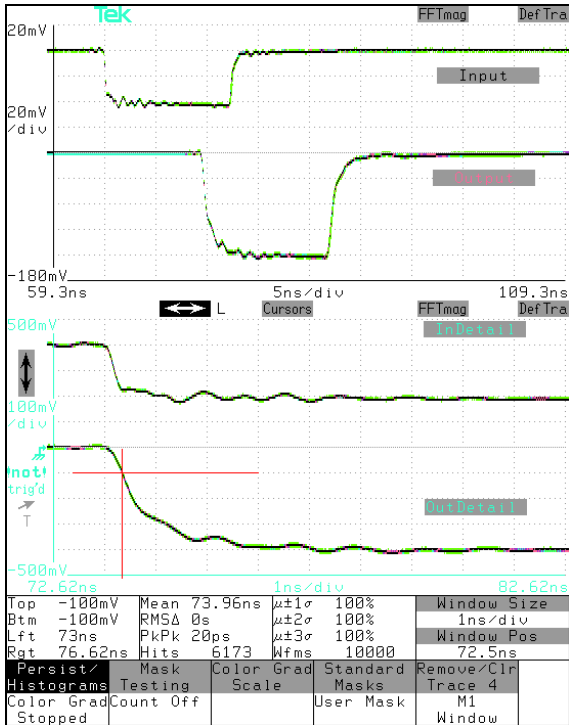


Simulated voltage gain of all TAx amplifiers

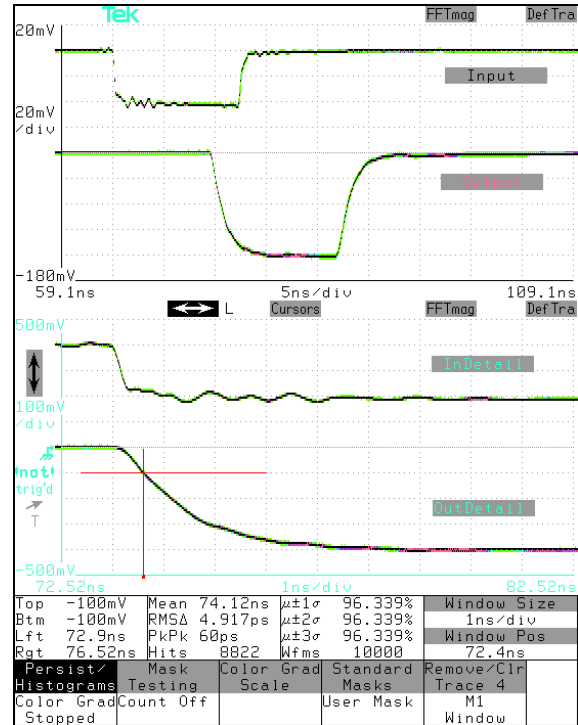
0 ... -400mV_{p,p} Pulse Response:

In the following scope pictures you see the pulse response for negative output signals starting at 0V and falling down to -400mV.

The input pulse amplitudes are selected according to the gain of each amplifier.

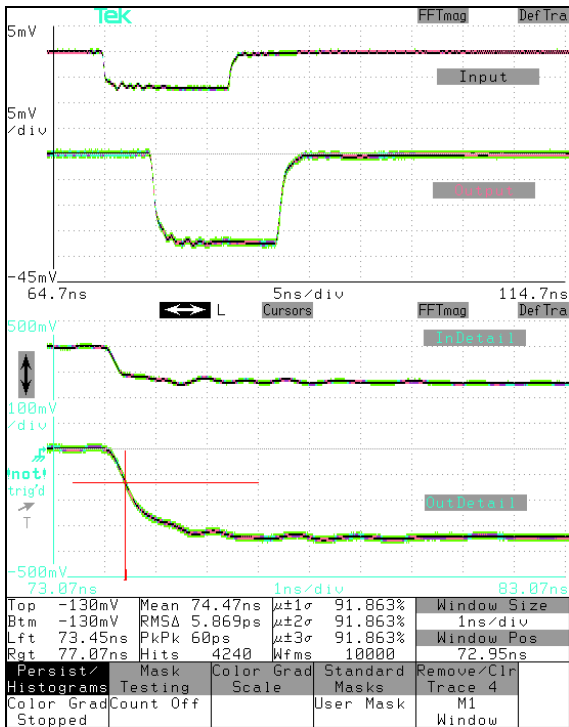


TA1000B-10 (x10), Input 20mV/div, Output 100mV/div

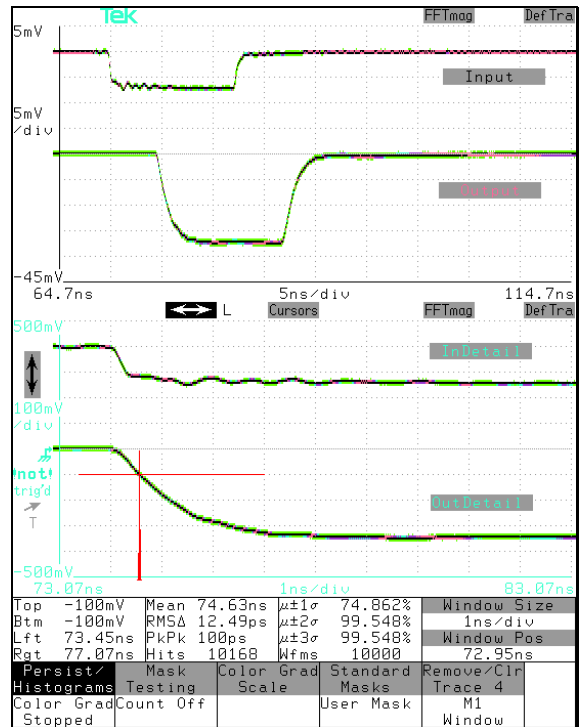


TA1000B-10BWL (x10), Input 20mV/div, Output 100mV/div

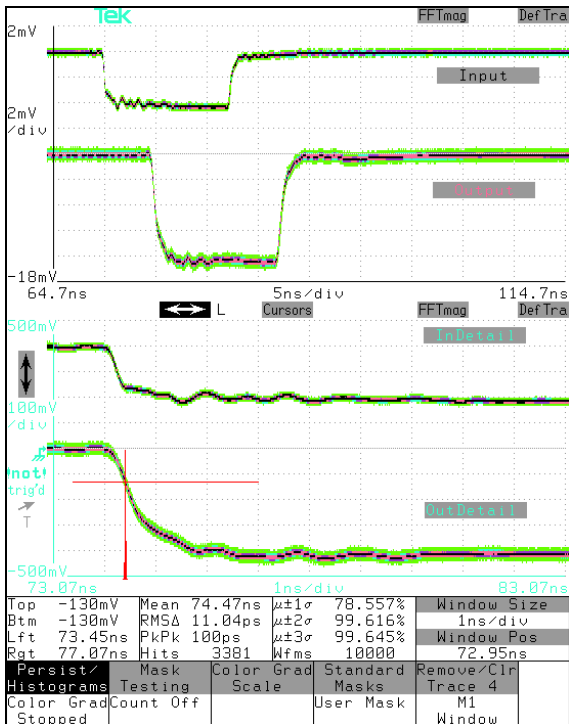
TA1000B-10/-50/-100/-200 Fast Pulse / Timing Preamplifier x10/x50/x100/x200, very low noise, DC coupled



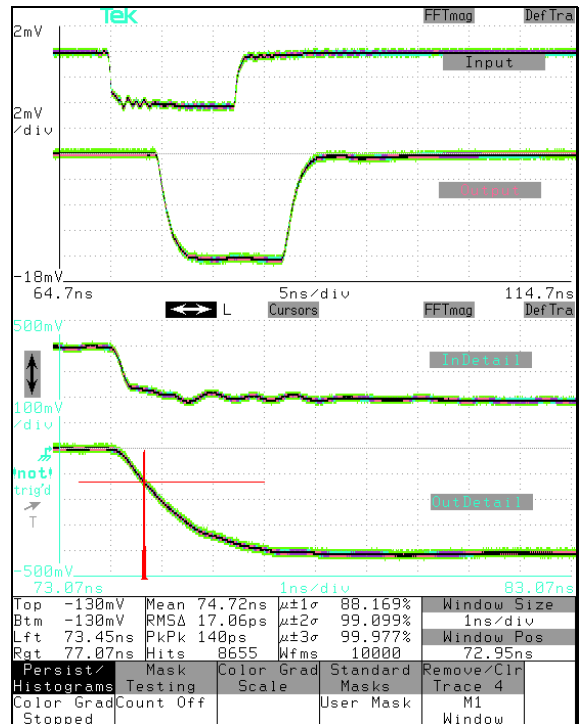
TA1000B-50 (x50), Input 5mV/div, Output 100mV/div



TA1000B-50BWL (x50), Input 5mV/div, Output 100mV/div

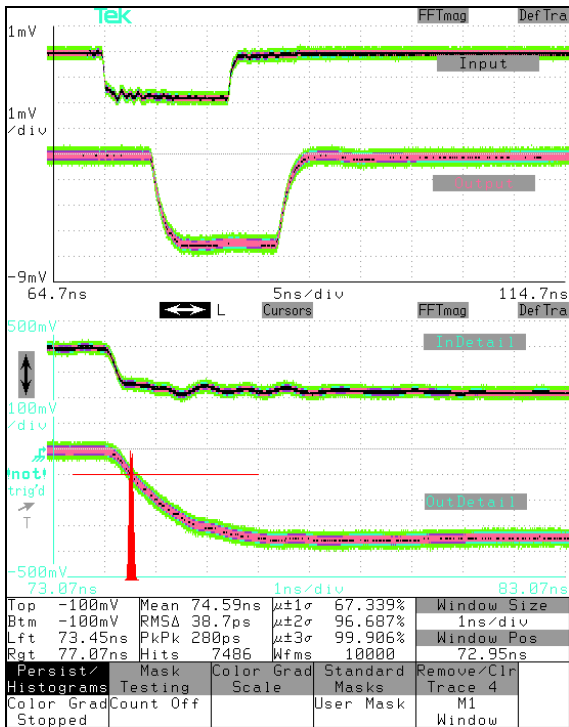


TA1000B-100 (x100), Input 2mV/div, Output 100mV/div



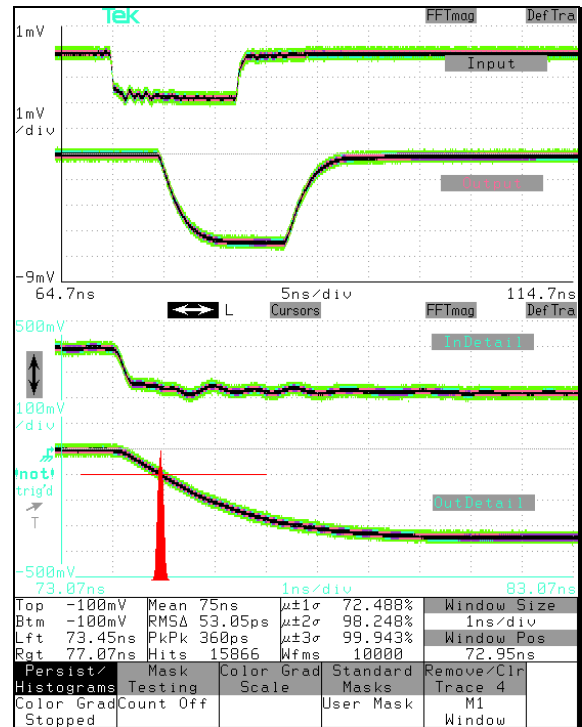
TA1000B-100BWL (x100), Input 2mV/div, Output 100mV/div

TA1000B-10/-50/-100/-200 Fast Pulse / Timing Preamplifier x10/x50/x100/x200, very low noise, DC coupled



TA1000B-200 (x200), Input 1mV/div, Output 100mV/div

The lower window of each plot shows details of the corresponding signals in the upper window. There is also a (red colored) histogram of the output signal jitter at a -100mV or -130mV threshold. The jitter's Peak-to-Peak value is visible at "PkPk" and its standard deviation in the "RMS Δ " readout.

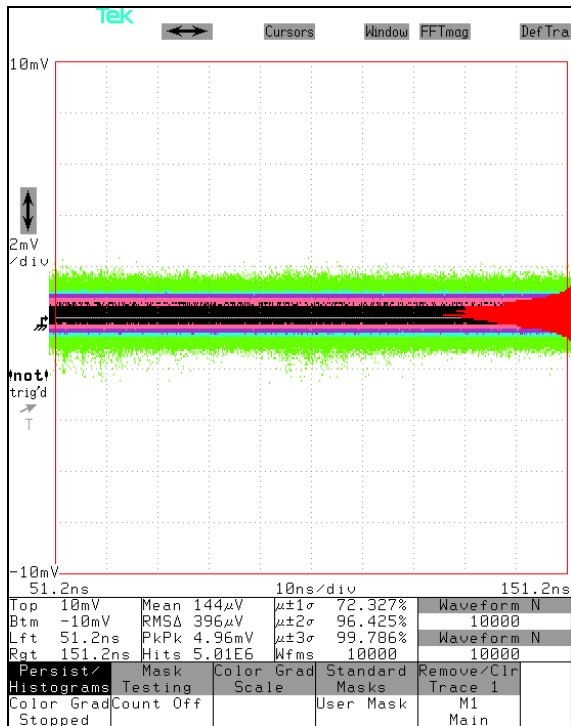


TA1000B-200BWL (x200), Input 1mV/div, Output 100mV/div

This jitter histogram gives a good indication of the timing accuracy and resolution that can be expected. And, one can very well see that the optimum threshold setting for timing measurements is often not at half of the signal's amplitude but at some other level not too far from idle voltage where the slew rate is at maximum.

TA1000B-10/-50/-100/-200 Fast Pulse / Timing Preamp x10/x50/x100/x200, very low noise, DC coupled

Max. Output Broadband Noise Voltage:

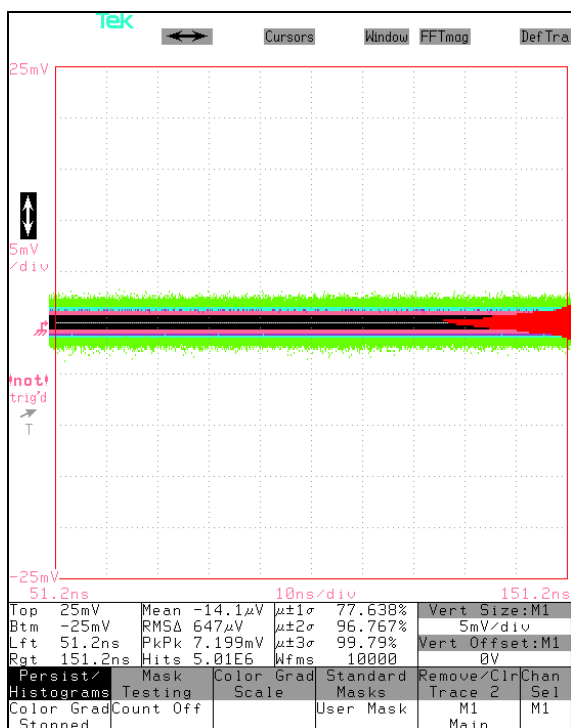


Sampling Head alone, 2mV/div

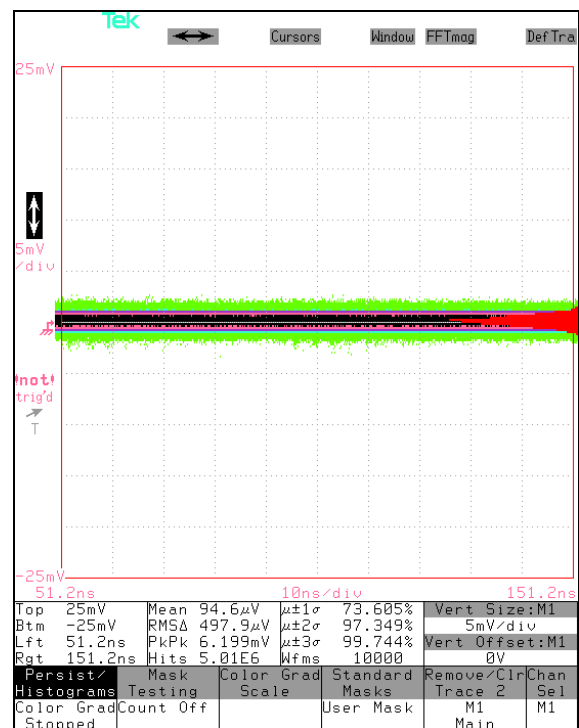
Normally the noise is given input referred, so to speak, it can be compared to the source signal levels. For timing applications it is often more depicting to plot the total output noise of an amplifier.

In the following scope pictures the output noise voltage of our TAx-amplifiers is accumulated over 10,000 waveforms corresponding to about 40 minutes of measurement time. Used was a TEK11801C digital sampling scope with a 12.5GHz sampling head. Thus, the displayed noise voltage is accumulated over a long period and also over the full bandwidth of each amplifier. The TAx's inputs were shortened, i.e. $Z_{Source} = 0\Omega$.

On the right side of each plot you can see a (red colored) histogram of all the voltage samples in the respective picture. This gives the probability distribution of the noise voltage levels. And, you can find some analysis data on the respective voltage distribution: **Mean** = average value, **RMSΔ** = σ = standard deviation, **PkPk** = Peak-to-Peak voltage = max. – min. sample voltage, **$\mu \pm 1\sigma$** = percentage of samples that fall within ± 1 standard deviation of the mean ($\pm 2\sigma$, $\pm 3\sigma$ respectively).

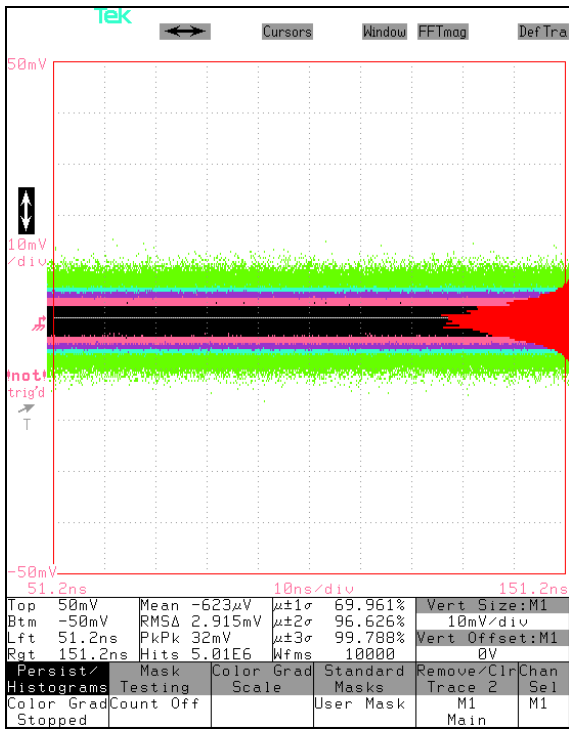


TA1000B-10 (x10), 5mV/div

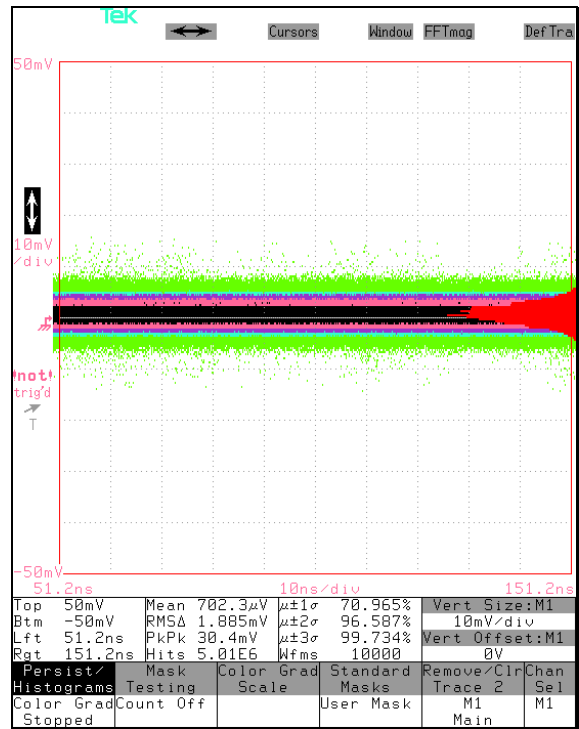


TA1000B-10 BWL (x10), 5mV/div

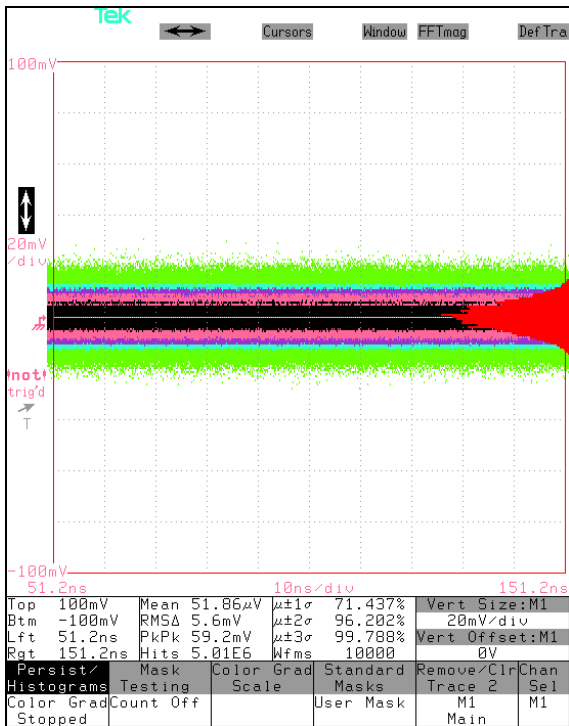
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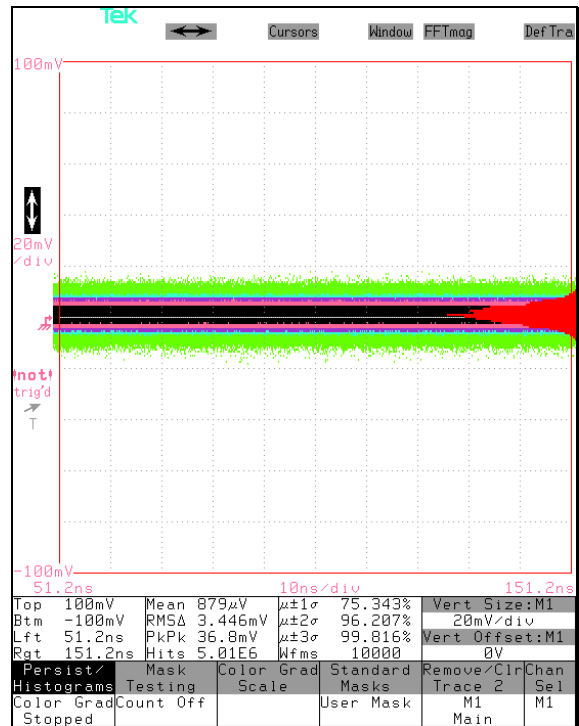
TA1000B-50 (x50), 10mV/div



TA1000B-50 BWL (x50), 10mV/div

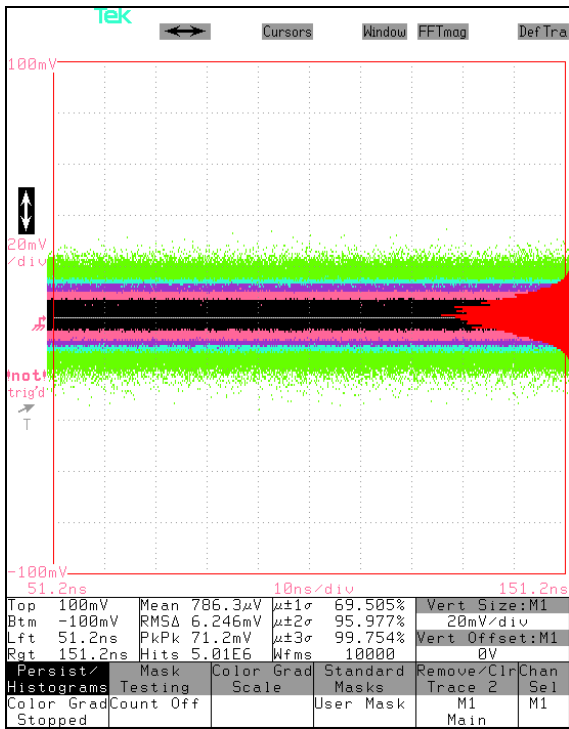


TA1000B-100 (x100), 20mV/div

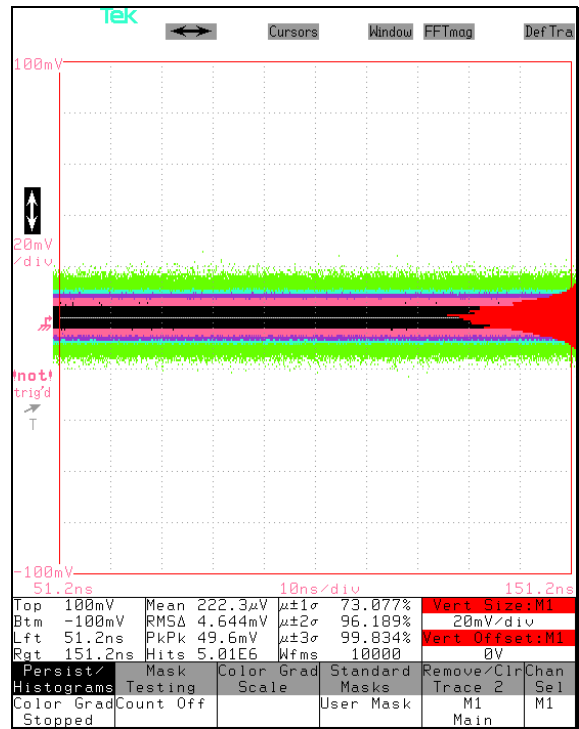


TA1000B-100 BWL (x100), 20mV/div

TA1000B-10/-50/-100/-200 Fast Pulse / Timing Preamplifier x10/x50/x100/x200, very low noise, DC coupled



TA1000B-200 (x200), 20mV/div



TA1000B-200 BWL (x200), 20mV/div