Differential Amplifiers

DA 1855A

Leading Features

- 100ns Overdrive Recovery
- DC to 100 MHz Bandwidth
- 100,000 to 1 CMRR
- Gain 1 or 10
- Very Low Noise

The DA1855A is a stand-alone, high-performance 100 MHz differential amplifier. It is intended to act as a signal conditioning preamplifier for oscilloscopes, digitizers and spectrum analyzers, providing differential measurement capability to instruments having only a single-ended input. When used with a DA1855A, oscilloscopes can obtain Common Mode Rejection Ratio (CMRR) and overdrive recovery performance levels previously unobtainable.
Amplifier gain can be set to 1 or 10. A built-in input attenuator can be separately set to attenuate signals by a factor of 10, providing gains of 10, 1, or 0.1 and common mode dynamic range of ±15.5 V (÷1) or ±155 V (÷10). Optional probes increase the maximum input signal and common mode ranges in proportion to their attenuation ratio but do not exceed their maximum input voltage rating. Effective gain of the DA1855A, including probe attenuation, amplifier gain and attenuator settings, is automatically displayed.
The DA1855A has a bandwidth of 100 MHz, but any one of the three 3-pole bandwidth limit filters can be selected to reduce bandwidth to
20 MHz, 1 MHz or 100 kHz to limit noise above the frequency of interest.
The DA1855A output is carefully limited to ±500 mV, so that the oscilloscope is not overdriven by large inputs. This allows many oscilloscopes to directly measure the settling of D/A converters with 14-bit (60 ppm) precision, better than any other differential comparator.
The DA1855A features a built-in Precision Voltage Generator (PVG) that can be set to any voltage between ±15.5 volts (±10 volts in Differential Offset) with up to 100 µV resolution. The PVG's output can be selected as an input to the inverting (-) input of the amplifier for operation as a differential comparator or applied internally as a true differential offset voltage. The PVG is also available for external use through a rear panel connector.
The DA1855A operates from 90 to 250 VAC line without line switching.
High-performance differential probes such as the DXC100 ÷10/÷100 high

CMRR probes are recommended.

Overdrive Recovery

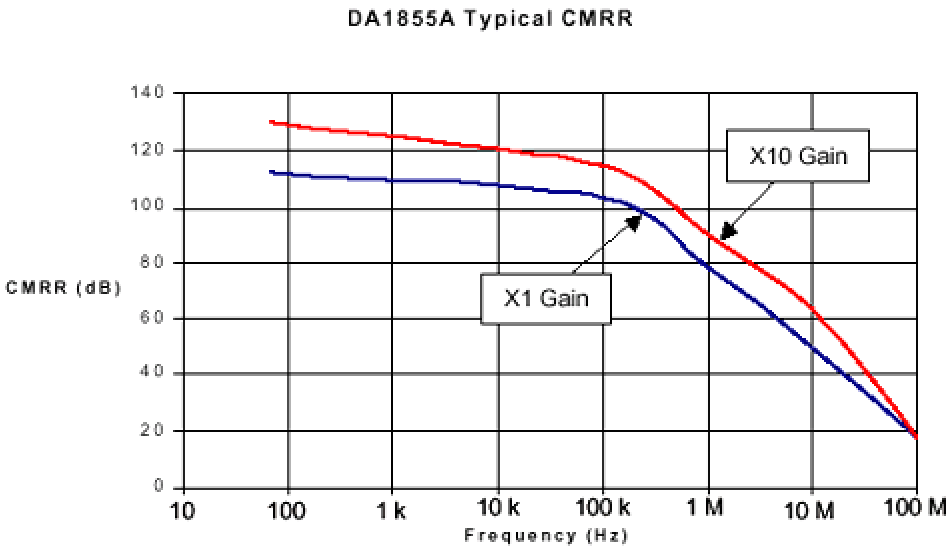
With a ÷100 probe, the DA1855 settles to within 100 mV referred to input, from a 400 V input signal within 100 ns. With attenuating probes, this allows the in circuit measurement of dynamic saturation in switch mode power converter switching devices.

Comparator Mode

The DA1855A becomes a differential comparator when the internal Precision Voltage Generator (PVG) output is selected as the amplifier's inverting (-) input. In this mode, the DA1855A can be used to very accurately measure relatively small signals that are riding on large AC or DC components. Due to the precision of the voltage generator, an oscilloscope, when used with the DA1855A, can make voltage measurements that are much more accurate than the oscilloscope is capable of by itself. The output of the PVG is available for external use via a rear panel connector.

True Differential Offset Mode

The DA1855A has built-in Precision Voltage Generator can be used to generate a true differential offset while still allowing both inputs to be used as differential inputs. The offset range can be as high as ±50,000 divisions and the generator has 5 $^{1}/_{2}$ digit resolution. This mode facilitates making measurements such as changes to a transistor's base to emitter voltage caused by variations in temperature and/or current. Used in this mode, the voltage generator can be set to a value that will zero out the static value of the junction's on voltage. The DA1855A's differential measurement capability will reject any dynamic signal common to both sides of the junction, and the oscilloscope is left to measure only the changes in the junction voltage.



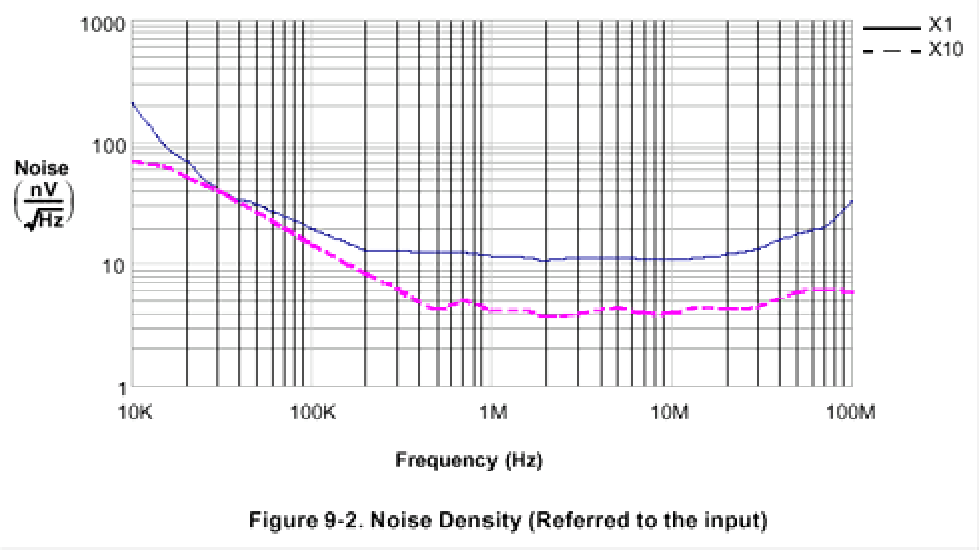


Figure 9-2. Noise Density (Referred to the input)

Autobalance

Each time either gain setting button is pressed, the DA1855A automatically adjusts the amplifier's DC Balance.

Specifications

Nominal	
Amplifier gain:	x1 or x10
Output impedance:	50 ohm
Intended output load:	50 ohm
Maximum output:	limited at ±0.50 V into 50 ohm.
Input attenuation:	÷1 or ÷10
Overdrive Recovery	In X10 gain, amplifier settles within 1 mV
Input Resistance:	
(÷1 Attenuator, x1 or	1 MΩ or 100 MΩ
(÷10 Attenuator, x1 or	1 MΩ
Input capacitance	20 pF
Bandwidth limit filters:	20 MHz,1.0 MHz and 100 kHz
Filter characteristics:	18 dB/octave (3-pole Bessel)
+ Input selections:	AC, OFF (precharge), DC

+ Input selections:	AC, OFF (precharge), DC
- Input selections:	AC, OFF (precharge), DC, Vcomp
Input coupling capacitor:	0.1 µF, 400 V DC
Input protection:	protected to ±250 V, automatic input disconnect with manual reset.

Differential offset accuracy:

(Typical)

(x10 GAIN, ÷1 Attenuator):	0.1% + 50 μV^2
(x1 GAIN,÷1 Attenuator):	0.1% + 500 μV^2
(x10 GAIN, ÷10 Attenuator):	0.15% + 500 μV^2
(x1 GAIN, ÷10 Attenuator):	0.15% + 5 mV^2

Warranted Characteristics

Gain accuracy: ±1% + uncertainty of termination resistance

Output Zero: ≤2 mV referred to input

Bandwidth: >100 MHz (X1 gain, -3dB)

Risetime: <3.5 ns (calculated from bandwidth)

Common mode rejection ratio, X1 or X10 Gain, ÷1 Attenuation:

≥ 50,000:1 (94 dB) @ 70 Hz
≥ 50,000:1 (94 dB) @ 100 kHz
≥ 316:1 (50 dB) @ 10 MHz

Dynamic Ranges

Max differential linear input:

$$\frac{\text{500 mV}}{\text{Gain Setting}} \text{ x (combined internal and probe's attenuation factor)}$$

(x10 GAIN, ÷1 Attenuator): ±50mV or ±0.5 V with ÷10 probe

(x1 GAIN, ÷1 Attenuator):	±0.5V or ±5.0 V with ÷10 probe
(x10 GAIN, ÷10 Attenuator):	±0.5V or ±5.0 V with ÷10 probe
(x1 GAIN, ÷10 Attenuator):	±5.0V or ±50 V with ÷10 probe

Maximum input slew rate:

(÷1 Attenuator, ÷1 probe):	0.15 V/µs
(÷10 Attenuator or ÷10 probe):	1.5 V/µs
(÷10 Attenuator and ÷10 probe):	15 V/µs
(÷1 Attenuator and ÷100 probe):	15 V/µs
(÷10 Attenuator and ÷100 probe):	150 V/µs

Max Common Mode Range:

(÷1 Attenuator):	±15.5 V (x1 or x10 GAIN)
(÷10 Attenuator):	±155 V (x1 or x10 GAIN)
(÷10 Attenuator and x10 probe):	±1.55 kV (x1 or x10 GAIN)

Differential Offset Range (V_{DIFF} mode referred to input)

(x10 GAIN, ÷1 Attenuator):	±1 V
(x1 GAIN, ÷1 Attenuator):	±10 V
(x10 GAIN, ÷10 Attenuator):	±10 V
(x1 GAIN, ÷10 Attenuator):	±100 V
(x1 GAIN, ÷10 Attenuator, x10 probe):	±1.0 kV

Comparison Offset Range (V_{comp} mode, referred to input):

(÷1 Attenuator):	±15.5 V (x1 or x10 GAIN)
(÷10 Attenuator):	±155 V (x1 or x10 GAIN)

(x10 probe and ÷10 Attenuator):	1.55 kV (x1 or x10 GAIN)

Precision Voltage Source

Output range:	±15.5 V
DC accuracy:	0.05% of reading +500 µV (15° to 45°C)
Control:	Oscilloscope offset knob

Power Requirements

Line voltage requirement:	90 to 250 V AC
Line frequency range:	45 - 66 Hz
Power Consumption:	~28 W, ~ 39 VA

Environmental Characteristics

Operating Range:	0° to 50°C
Non-Operating:	-4° to 75°C

Physical Characteristics

Height:	7.29 cm (2.87")
Width:	21.2 cm (8.36")
Depth:	23.2 cm (9.12")
Weight:	2.15 kg (4.75 lb)
Shipping Weight:	3.12 kg (6.88 lb)