

## PRECISION POWER ANALOG PRODUCT REFERENCE GUIDE FOR

# NANOSCALE IMAGING APPLICATIONS



| Model | Output Current<br>continuous (A) | Power Supply Voltage<br>max (V) | Slew Rate<br>TYP (V/μs) | Settling Time to 0.1%<br>(μs) | Quiescent Current<br>Typ (mA) | Package                |
|-------|----------------------------------|---------------------------------|-------------------------|-------------------------------|-------------------------------|------------------------|
| PA107 | 1.5                              | Vs ±100, Vaux ±18               | 3000                    | 12                            | Vs: 30, Vaux: 19              | 12-pin PowerSIP (DP)   |
| PA194 | 0.1                              | ±450                            | 2100                    | 1                             | 25                            | 8-pin PowerSIP (GN)    |
| PA85  | 0.2                              | ±225                            | 1000                    | 1                             | 21                            | 8-pin TO-3 (CE)        |
| PA98  | 0.2                              | ±225                            | 1000                    | 1                             | 21                            | 12-pin PowerSIP (DP)   |
| PB63  | 2 (x2channels)                   | ±75                             | 1000                    | 0.3                           | 37                            | 12-pin PowerSIP (DP)   |
| PA119 | 5                                | ±40                             | 900                     | 0.3                           | 100                           | 8-pin TO-3 (CE)        |
| PA94  | 0.1                              | 450                             | 700                     | 1                             | 17                            | 8-pin PowerSIP (DQ)    |
| PA78  | 0.15                             | ±175                            | 350                     | 1                             | 0.7                           | 20-pin PSOP (DK)       |
| PA91  | 0.2                              | ±225                            | 300                     | 1                             | 10                            | 12-pin PowerSIP (DP)   |
| PA90  | 0.2                              | ±200                            | 300                     | 1                             | 10                            | 12-pin PowerSIP (DP)   |
| PA96  | 1.5                              | ±150                            | 250                     | 2                             | 30                            | 8-pin TO-3 (CE)        |
| PA09  | 4.5                              | ±40                             | 220                     | 1.3                           | 85                            | 8-pin TO-3 (CE)        |
| PA84  | 0.04 PEAK                        | ±150                            | 200                     | 12                            | 5.5                           | 8-pin TO-3 (CE)        |
| MP108 | 10                               | ±100                            | 170                     | 1                             | 50                            | 34-pin DIP (FD)        |
| MP111 | 15                               | ±50                             | 130                     | 1                             | 142                           | 34-pin Open Frame (FD) |
| PB50  | 2                                | ±100                            | 100                     | 2                             | 12                            | 8-pin TO-3 (CE)        |
| PB51  | 1.5                              | ±150                            | 100                     | 2                             | 12                            | 12-pin PowerSIP (DP)   |
| PB58  | 1.5                              | ±150                            | 100                     | 2                             | 12                            | 8-pin TO-3 (CE)        |
| PA05  | 30                               | ±50                             | 100                     | 2.5                           | 90                            | 12-pin MO -127 (CR)    |
| PA93  | 8                                | ±200                            | 50                      | 1                             | 10                            | 12-pin SIP (DP)        |
| PA92  | 4                                | ±200                            | 50                      | 1                             | 10                            | 12-pin SIP (DP)        |
| PA99  | 0.05                             | ±1250                           | 30                      | -                             | 4                             | 12-pin PowerDIP (CW)   |
| PA95  | 0.1                              | ±450                            | 30                      | 1                             | 2.2                           | 8-pin SIP (DQ)         |
| PA89  | 0.075                            | ±600                            | 16                      | 2                             | 4.8                           | 12-pin MO-127 (DC)     |

## WHY APEX?



- All products are “off-the-shelf” to deliver high reliability and reduce design time



- In-house failure analysis



- Dedicated power analog applications engineering technical support to guide product selection, review schematics, and de-bug circuits



- Excellent thermal management allows for smaller designs with improved accuracy



- Documented and guaranteed performance in a smaller, lighter, and proven package



- Customer training and application seminars available

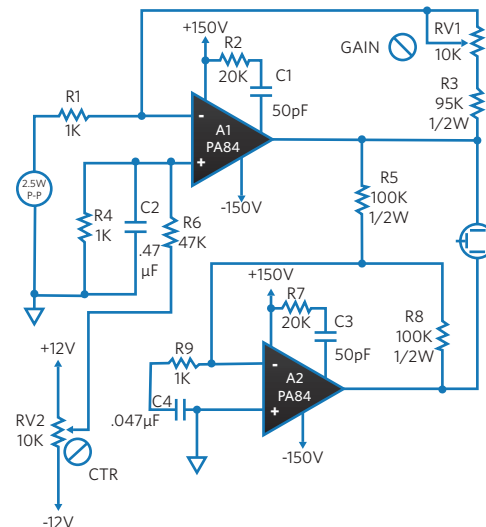
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## Electrostatic Deflection Applications

Due to their high-voltage and high-speed, Apex amplifiers excel in electrostatic deflection applications. The high voltages, upwards of 450V, are required to produce a strong enough electric field to deflect the particles over the full range of the medium. The high speeds, up to 3000V/ $\mu$ s, provide faster throughput and more rapid scans.

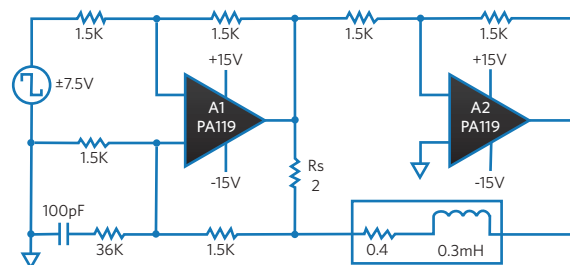
In this circuit, two PA84s are used in a bridge configuration across one axis of a 2-axis parallel plate deflector ("quadpole"). The bridge circuit essentially doubles the voltage and speed when compared to that of a single amplifier. Adjustment knobs for gain and offset are shown.

Electrostatic deflection is commonly used in scanning electron microscopes (SEMs) and other such nanoscale-imaging technologies. It is also used in particle sorting technologies such as laboratory mass spectrometers, cell sorters, and some cathode-ray tubes (CRTs).



## Electromagnetic Deflection Applications

Apex amplifiers are well-suited to meet the high-speed and high-current demands of electromagnetic deflection applications. The Apex amplifier used in an electromagnetic deflection circuit will typically be one that can carry high current, on the range of 1 to 10 Amperes (although sometimes as high as 80A peak!). Faster throughput is provided through high speeds of up to 3000V/ $\mu$ s.



The circuit to the right shows two PA119s in a bridged voltage-controlled-current-source (VCCS). This bridge circuit offers double the voltage and double the power bandwidth of a single PA119. A VCCS circuit is used to control the current in the coil, as the current in a coil is directly related to the strength of its magnetic field.

Electromagnetic deflection is an excellent choice for deflecting particles over a wide angle; meanwhile, electrostatic deflection is limited to a spread angle of about 10 degrees. For this reason, electromagnetic deflection is more commonly found in benchtop mass spectrometers and cathode-ray tubes (CRTs).

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