Tech Alert

PA107 Rules of Operation

On several occasions, PA107 has been described as a "wild mustang," - a beast with enormous reserves of power, but it can be difficult to tame. PA107 is a highly capable power amplifier. With one of the fastest slew rates on the market, peak currents of up to 5A, and a wide 170V_{p-p} output range, this part can fill many sockets. However, its lack of protection features and highly dynamic supply current mean the PA107 can easily destroy itself during first-stage prototyping.

The following rules help prevent such tragedies. These rules are great practices for all Apex power operational amplifiers, but are particularly necessary for PA107. With these rules and a watchful eye, PA107 can be evaluated safely and reliably.

RULE 1

Start with low supply voltages to make sure the supplies will not overshoot. $\pm V_S$ can go as low as ±20V, so start here. Even ±48V is better than starting at full voltage.

Many engineers will buy a fresh PA107, four new 48V supplies, hook them all together without evaluating anything, and fry the hybrid device. The PA107 fails because the supplies have a power-on overshoot that kills some of the internal circuitry. This is why Apex recommends evaluating the supplies for power-on overshoot/power-off reversal and testing first with low supply voltages.

RULE 2

Use a heatsink and large power supply bypass capacitors, even unloaded.

At high frequencies/high slew rates, the supply current can skyrocket, even when the amplifier is unloaded. While the parts are always capable of 2500 V/µs or better, it comes at the cost of stricter power supply bypass capacitor requirements and better heatsinking.

RULE 3

Start testing while the PA107 is unloaded, driven at low frequency, and with an input signal that will not cause the output to saturate. View the output with an oscilloscope and keep an eye on the supply cur rent.

These are good considerations for any Apex part. For the PA107 specifically, overdriving the input (causing the output to saturate) will increase supply current to dangerous levels.

RULE 4

Sequencing:

a.Turn on $\pm V_{AUX}$

b.Turn on $\pm V_S$ and $\pm V_{SP}$ ($+V_S$ should be shorted to $+V_{SP}$, and $-V_S$ should be shorted to $-V_{SP}$)

c.**Turn on input signal (should have been 0 volts up to now)**

d.Normal Operation

e.Turn off input signal

f.Turn off $\pm V_S$ and $\pm V_{SP}$

g.Turn off $\pm V_{AUX}$

Changing the order of supplies often comes without consequence. However, if you turn on the signal before all the supplies are on, the output latches to the positive rail, and the supply current rises to some where around half an amp. A few seconds of this will not destroy the PA107, but it quickly gets hot. If the junctions don't get too hot, turning off the supplies and properly sequencing will return the PA107 to normal.

RULE 5

Use input protection diodes (anti-parallel 1N4148s between pins 1 and 4).

Input protection diodes solve the latching and saturation issues. They limit non-linear transitions (caused by transients or square waves) to 0.6V on the input pin.

RULE 6

PA107 works very well at delivering high-speed pulses to a load; that's what it was designed for. Its sine wave response is not perfect. Even at 1 MHz, the trained eye can spot some distortion in a sinewave out put. Apex has investigated this issue many times, but it often boils down to the fact that most customers use this part for high-speed pulses rather than sinewave outputs.

RULE 7

Work your way up to the design requirements, keeping an eye on supply current and case temperature. Apex's Power Design software tool can be used to determine safe frequencies, supply currents, and case temperatures with various loads.

RULE 8

A general rule of thumb is to always stay in the linear region of the amplifier. If you put in a signal that will exceed the slew rate of PA107, the PA107 is going to do its best to achieve that. That means more supply current. Which means more heat. Which means lower MTTF.

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