

March 1993

Wideband Operational Amplifier

Features

- High Open Loop Gain at Video Frequencies 42dB (Typ.) at 1MHz
- High Unity Gain Crossover Frequency (f_T) 38MHz (Typ.)
- Wide Power Bandwidth $V_O = 18V_{p-p}$ 1.2MHz(Typ.)
- High Slew Rate
 - 20dB Amplifier 70V/ μ s (Typ.)
 - Unity Gain Amplifier..... 25V/ μ s (Typ.)
- Fast Settling Time 0.6 μ s (Typ.)
- High Output Current $\pm 15mA$ Min.
- Single Capacitor Compensation
- Offset Null Terminals

Applications

- Video Amplifiers
- Fast Peak Detectors
- Meter Driver Amplifiers
- High Frequency Feedback Amplifiers
- Video Pre-Drivers
- Oscillators
- Multivibrators
- Voltage Controlled Oscillator
- Fast Comparators

Description

The CA3100 is a large signal wideband, high speed operational amplifier which has a unity gain cross over frequency (f_T) of approximately 38MHz and an open loop, 3dB corner frequency of approximately 110kHz. It can operate at a total supply voltage of from 14V to 36V ($\pm 7V$ to $\pm 18V$ when using split supplies) and can provide at least 18V_{p-p} and 30mA_{p-p} at the output when operating from $\pm 15V$ supplies. The CA3100 can be compensated with a single external capacitor and has DC offset adjust terminals for those applications requiring offset null. (See Figure 14).

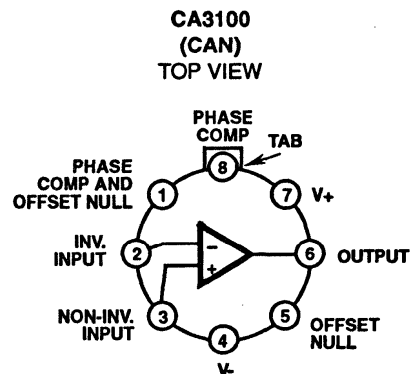
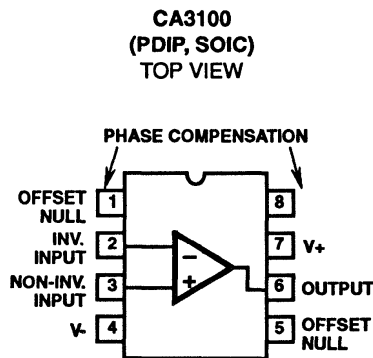
The CA3100 circuit contains both bipolar and PMOS transistors on a single monolithic chip..

Ordering Information

| PART NUMBER | TEMPERATURE RANGE | PACKAGE |
|-------------|-------------------|--------------------|
| CA3100E | -45°C to +85°C | 8 Lead Plastic DIP |
| CA3100M | -45°C to +85°C | 8 Lead SOIC |
| CA3100M96 | -45°C to +85°C | 8 Lead SOIC* |
| CA3100T | -55°C to +125°C | 8 Pin Can |

* Denotes Tape and Reel

Pinouts



Specifications CA3100

Absolute Maximum Ratings

| | |
|---|--------|
| Supply Voltage (Between V+ and V- Terminals)..... | 36V |
| Differential Input Voltage..... | 12V |
| Input Voltage to Ground (Note 1)..... | ±15V |
| Offset Terminal to V- Terminal Voltage..... | ±0.5V |
| Output Current (Note 2)..... | 50mA |
| Junction Temperature..... | +175°C |
| Junction Temperature (Plastic Package)..... | +150°C |
| Lead Temperature (Soldering 10 Sec.)..... | +300°C |

Operating Conditions

| | |
|--------------------------------|-----------------|
| Operating Temperature Range: | |
| E and M Types..... | -40°C to +85°C |
| S and T Types..... | -55°C to +125°C |
| Storage Temperature Range..... | -65°C to +150°C |

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

Electrical Specifications, at T_A = +25°C, Supply Voltage (V+, V-) = ±15V, Unless Otherwise Specified

| PARAMETER | SYMBOL | TEST CONDITIONS | LIMITS | | | UNITS |
|---|------------------|--|--------|------------|------|-------|
| | | | MIN | TYP | MAX | |
| STATIC | | | | | | |
| Input Offset Voltage | V _{IO} | V _O = 0 ± 0.1V | - | ±1 | ±5 | mV |
| Input Bias Current | I _{IB} | V _O = 0 ± 1V | - | 0.7 | 2 | μA |
| Input Offset Current | I _{IO} | V _O = 0 ± 1V | - | ±0.05 | ±0.4 | μA |
| Low Frequency Open Loop Voltage Gain (Note 3) | A _{OL} | V _O = ± 1V Peak, f = 1 kHz | 56 | 61 | - | dB |
| Common Mode Input Voltage Range | V _{ICR} | CMRR ≥ 76dB | ±12 | +14 -13 | - | V |
| Common Mode Rejection Ratio | CMRR | V _I Common Mode = ± 12V | 76 | 90 | - | dB |
| Maximum Output Voltage | | Differential Input Voltage = 0 ± 0.1V, R _L = 2kΩ | | | | |
| Positive | V _{OM+} | | +9 | +11 | - | V |
| Negative | V _{OM-} | -9 | -11 | - | V | |
| Maximum Output Current | | Differential Input Voltage = 0 + 0.1V, R _L = 250Ω | | | | |
| Positive | I _{OM+} | | +15 | +30 | - | mA |
| Negative | I _{OM-} | -15 | -30 | - | mA | |
| Supply Current | I ₊ | V _O = 0 ± 0.1V, R _L ≥ 10kΩ | - | 8.5 | 10.5 | mA |
| Power Supply Rejection Ratio | PSRR | ΔV ₊ = ± 1V, ΔV ₋ = ± 1V | 60 | 70 | - | dB |
| DYNAMIC | | | | | | |
| Unity-Gain Crossover Frequency | f _T | C _C = 0, V _O = 0.3V _{P-P} | - | 38 | - | MHz |
| 1MHz Open-Loop Voltage Gain | A _{OL} | f = 1MHz, C _C = 0, V _O = 10V _{P-P} | 36 | 42 | - | dB |
| Slew Rate | SR | | | | | |
| 20dB Amplifier | | A _V = 10, C _C = 0, V _I = 1V (Pulse) | 50 | 70 | - | V/μs |
| Follower Mode | | A _V = 1, C _C = 10pF, V _I = 10V (Pulse) | - | 25 | - | V/μs |
| Power Bandwidth (Note 4) | PBW | | | | | |
| 20dB Amplifier | | A _V = 10, C _C = 0, V _O = 18V _{P-P} | 0.8 | 1.2 | - | MHz |
| Follower Mode | | A _V = 1, C _C = 10pF, V _O = 18V _{P-P} | - | 0.4 | - | MHz |
| Open Loop Differential Input Impedance | Z _I | F = 1MHz | - | 30 | - | kΩ |
| Open-Loop Output Impedance | Z _O | F = 1MHz | - | 110 | - | Ω |

Specifications CA3100

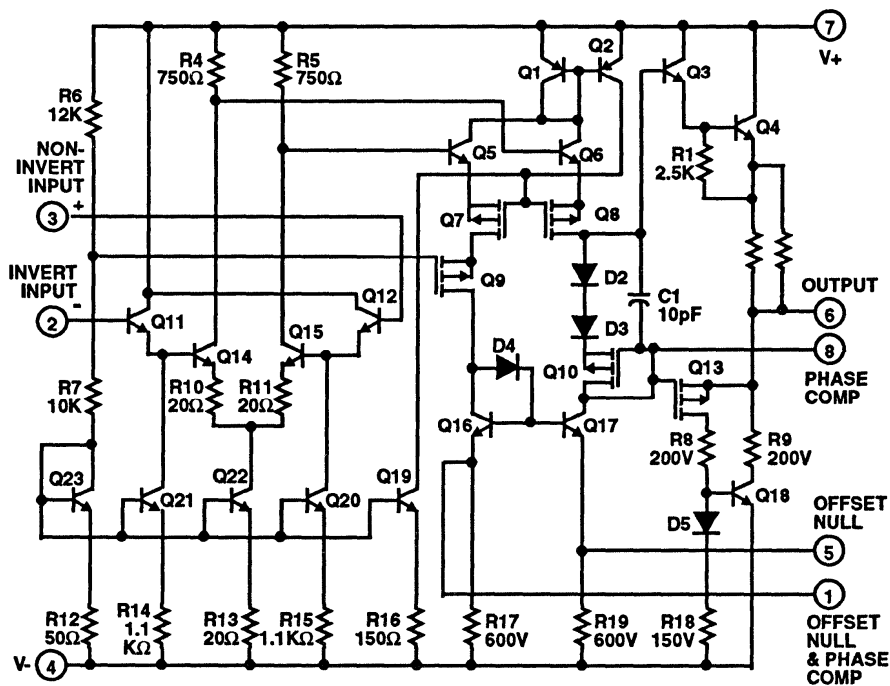
Electrical Specifications, at $T_A = +25^\circ\text{C}$, Supply Voltage (V_+ , V_-) = $\pm 15\text{V}$, Unless Otherwise Specified (Continued)

| PARAMETER | SYMBOL | TEST CONDITIONS | LIMITS | | | UNITS |
|---|---------------|---|--------|-----|-----|----------------------------|
| | | | MIN | TYP | MAX | |
| DYNAMIC (Continued) | | | | | | |
| Wideband Noise Voltage Referred to Input | e_N (Total) | $\text{BW} = 1\text{MHz}$, $R_S = 1\text{k}\Omega$ | - | 8 | - | μV_{RMS} |
| Settling Time (To Within $\pm 50\text{ mV}$ of 9V Output Swing) | t_S | $R_L = 2\text{k}\Omega$, $C_L = 20\text{pF}$ | - | 0.6 | - | μs |

NOTES:

1. If the supply voltage is less than $\pm 15\text{V}$, the maximum input voltage to ground is equal to the supply voltage.
2. CA3100 does not contain circuitry to protect against short circuits in the output.
3. Low frequency dynamic characteristic.
4. Power Bandwidth = $\frac{\text{Slew Rate}}{\pi V_{\text{OP-P}}}$

Schematic Diagram



Typical Performance Curves

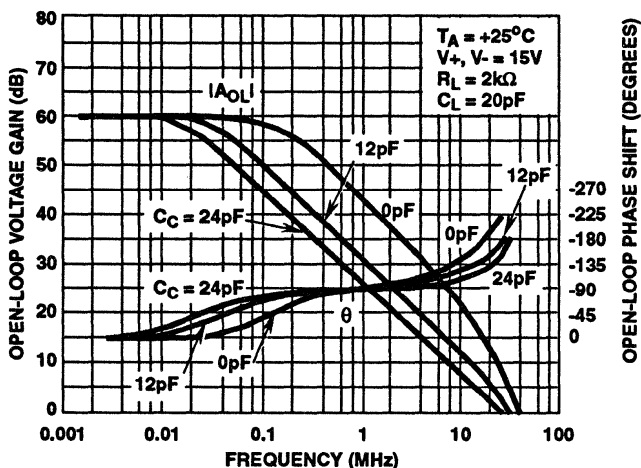


FIGURE 1. OPEN-LOOP GAIN, OPEN-LOOP PHASE SHIFT vs FREQUENCY

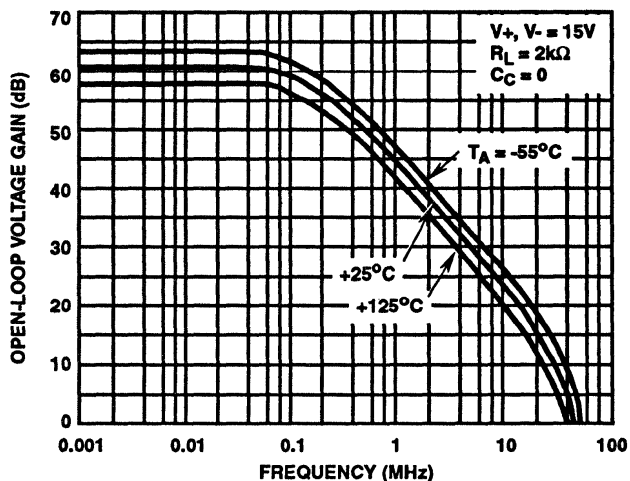


FIGURE 2. OPEN-LOOP GAIN vs FREQUENCY

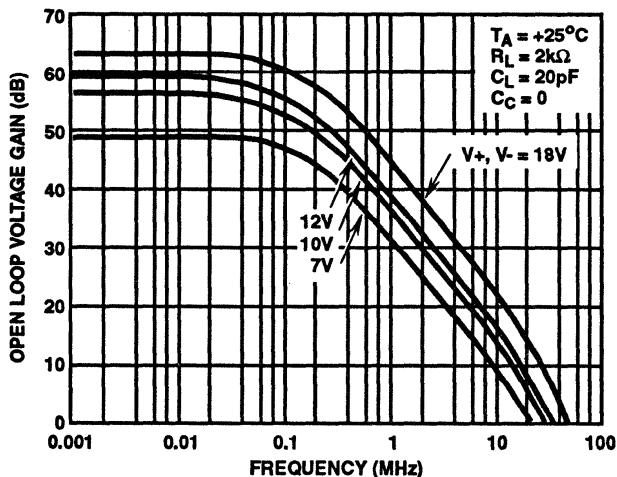


FIGURE 3. OPEN LOOP GAIN vs FREQUENCY

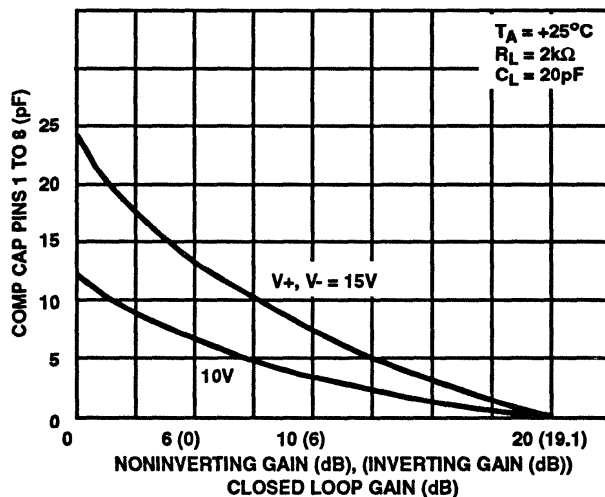


FIGURE 4. REQUIRED COMPENSATION CAPACITANCE vs CLOSED LOOP GAIN

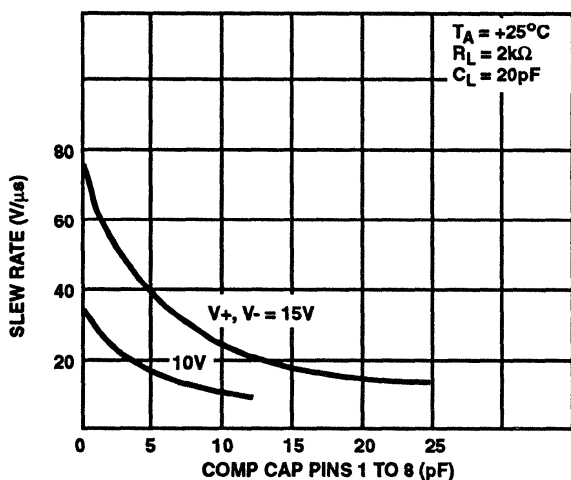


FIGURE 5. SLEW RATE vs COMPENSATION CAPACITANCE

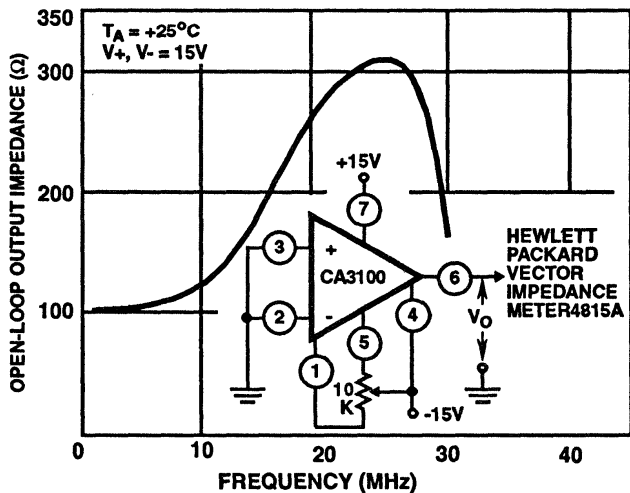


FIGURE 6. TYPICAL OPEN LOOP OUTPUT IMPEDANCE vs FREQUENCY

Typical Performance Curves (Continued)

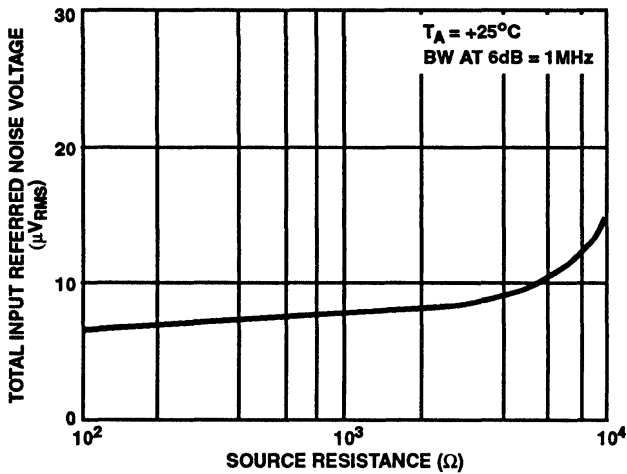


FIGURE 7. WIDEBAND INPUT NOISE VOLTAGE vs SOURCE RESISTANCE

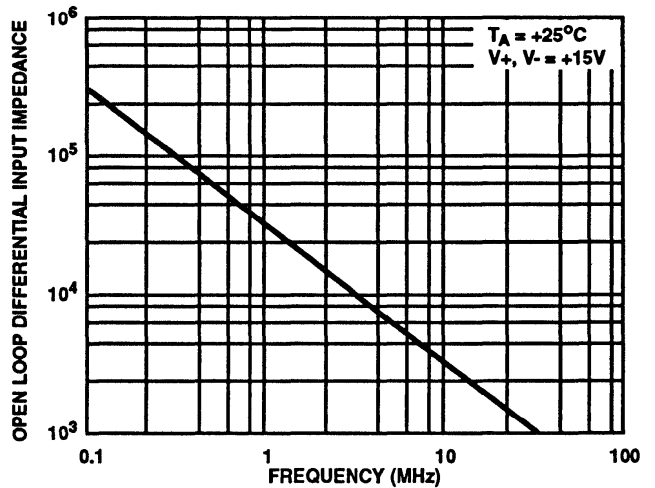


FIGURE 8. TYPICAL OPEN-LOOP DIFFERENTIAL INPUT IMPEDANCE vs FREQUENCY

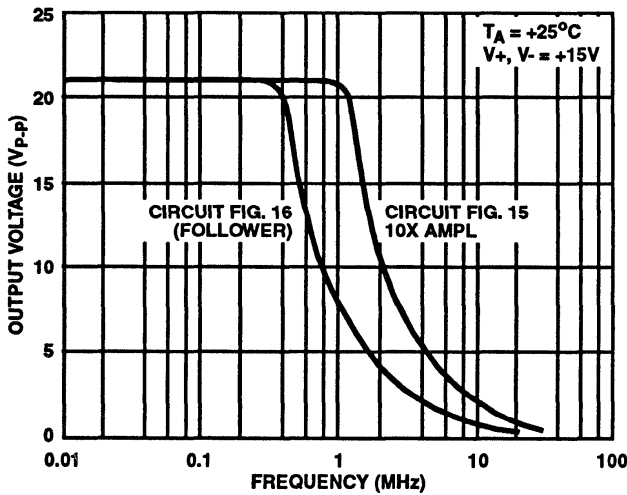


FIGURE 9. MAXIMUM OUTPUT VOLTAGE SWING vs FREQUENCY

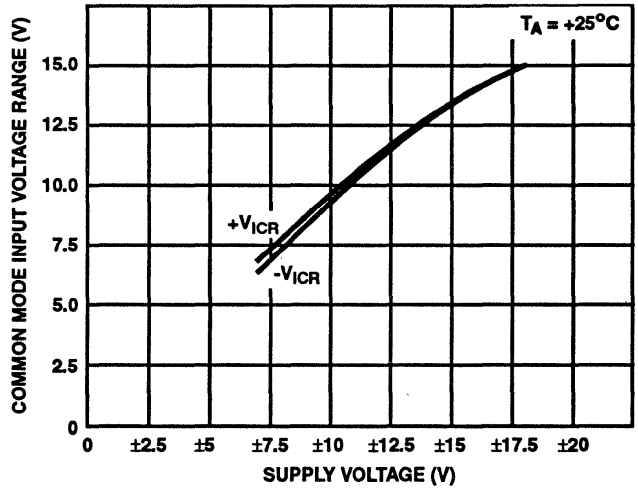


FIGURE 10. COMMON MODE INPUT VOLTAGE RANGE vs SUPPLY VOLTAGE

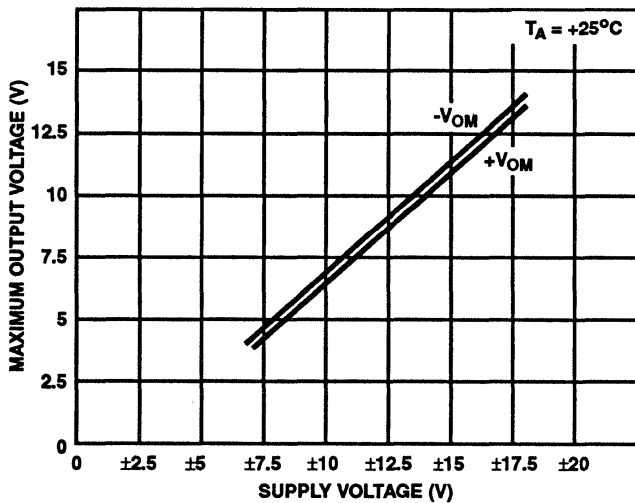


FIGURE 11. MAXIMUM OUTPUT VOLTAGE vs SUPPLY VOLTAGE

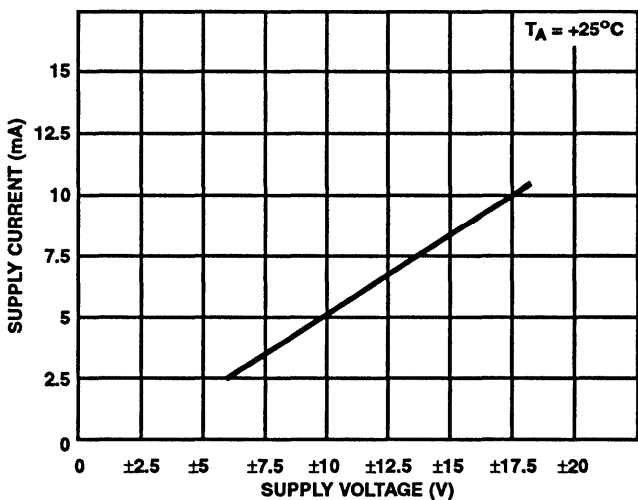


FIGURE 12. SUPPLY CURRENT vs SUPPLY VOLTAGE

CA3100

Typical Performance Curves (Continued)

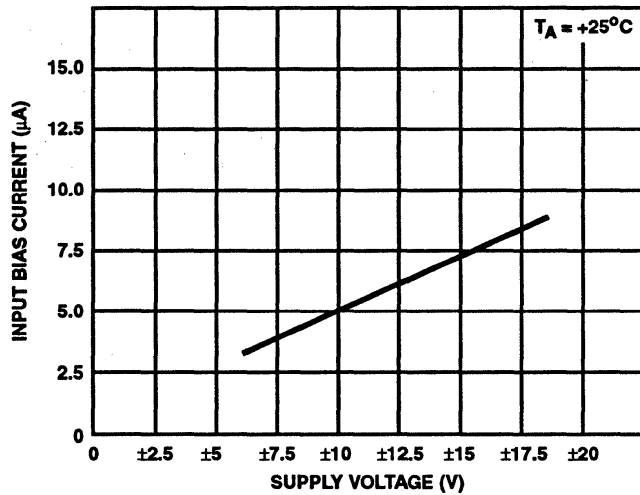


FIGURE 13. INPUT BIAS CURRENT vs SUPPLY VOLTAGE

Test Circuits

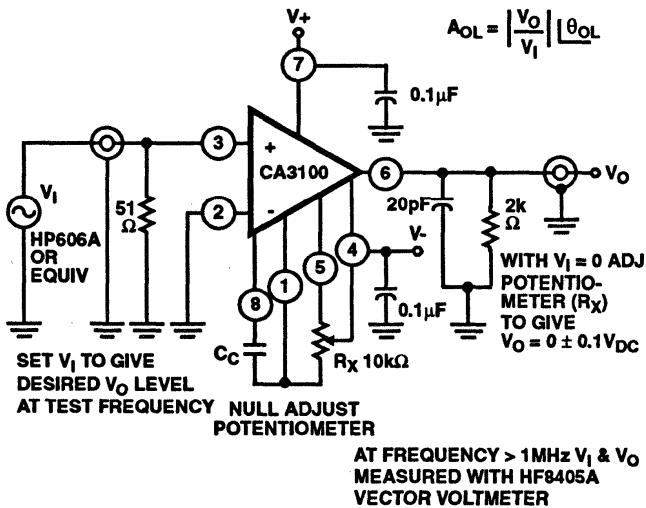


FIGURE 14. OPEN-LOOP VOLTAGE GAIN TEST CIRCUIT AND OFFSET ADJUST CIRCUIT

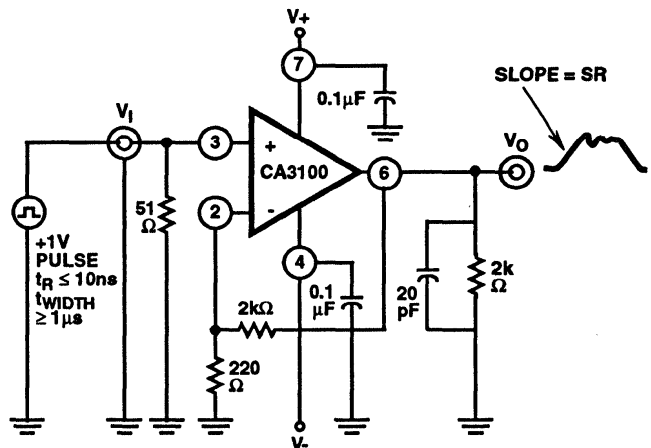


FIGURE 15. SLEW RATE IN 10X AMPLIFIER TEST CIRCUIT

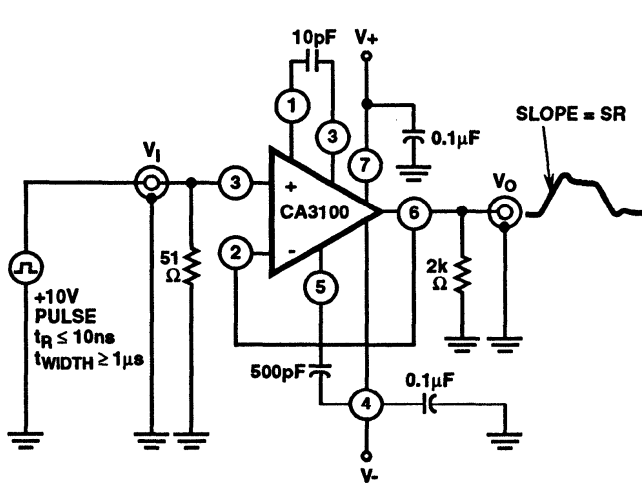


FIGURE 16. FOLLOWER SLEW RATE TEST CIRCUIT

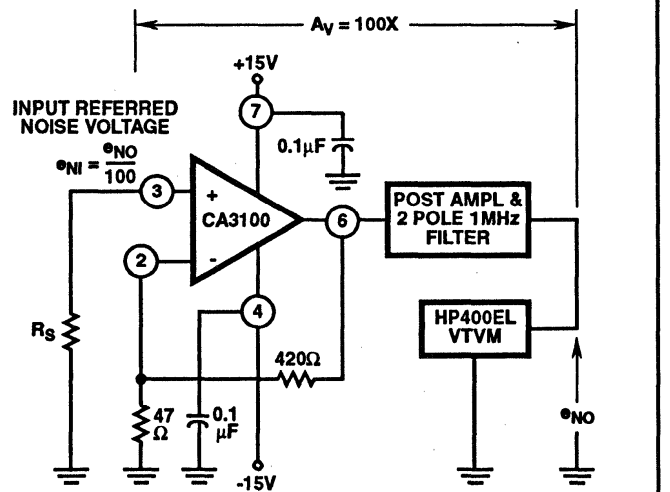


FIGURE 17. WIDEBAND INPUT NOISE VOLTAGE TEST CIRCUIT

Test Circuits (Continued)

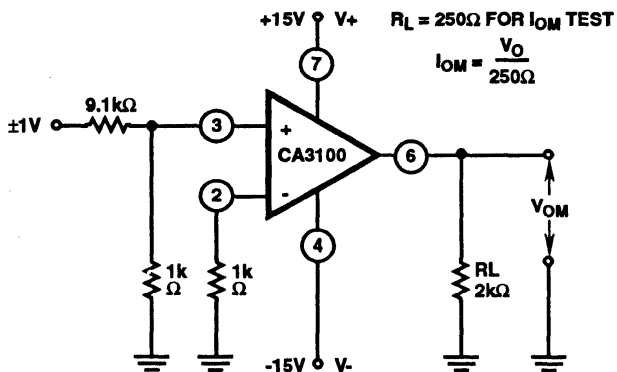


FIGURE 18. OUTPUT VOLTAGE SWING (V_{OM}), OUTPUT CURRENT SWING (I_{OM}) TEST CIRCUIT

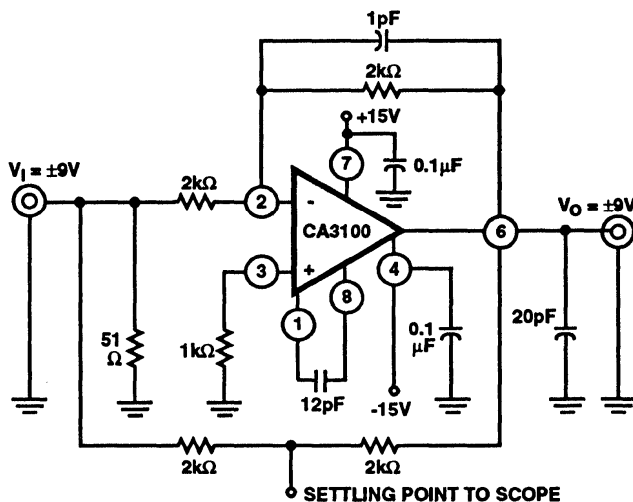


FIGURE 19. SETTLING TIME TEST CIRCUIT

Typical Applications

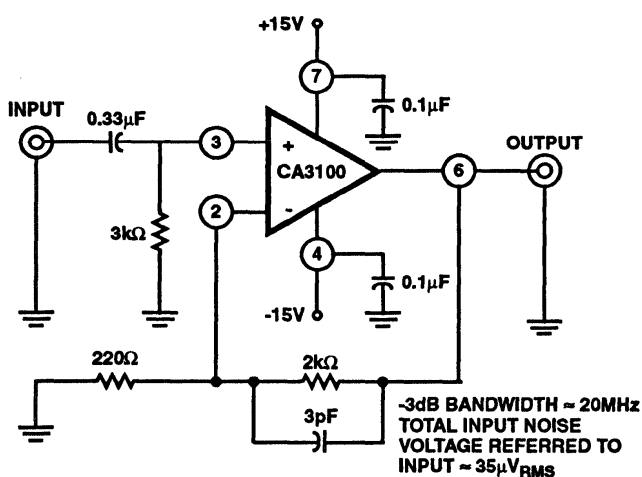


FIGURE 20. 20dB VIDEO AMPLIFIER

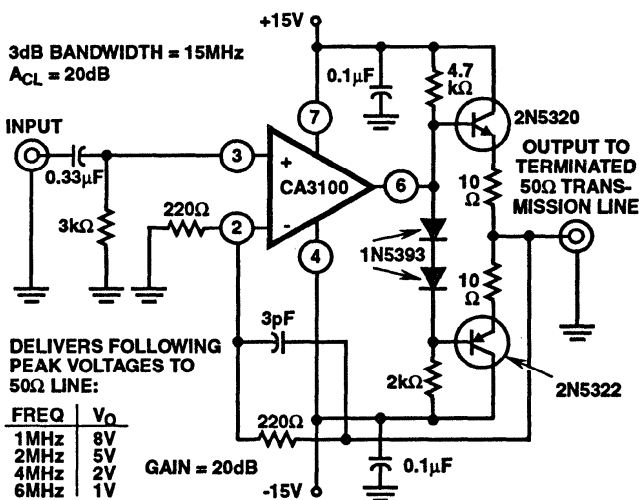


FIGURE 21. 20dB VIDEO LINE DRIVER

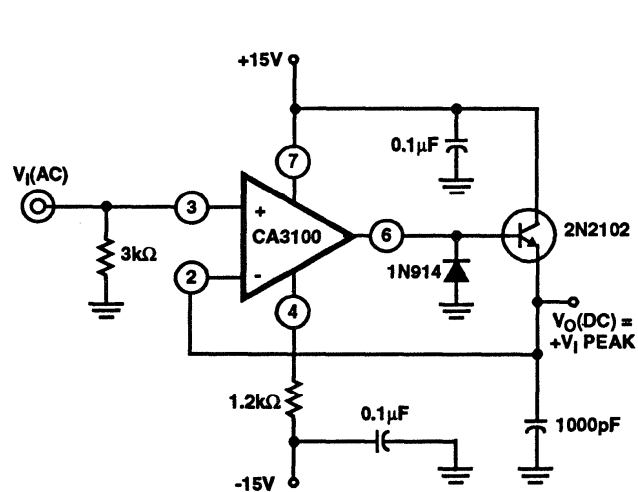


FIGURE 22. FAST POSITIVE PEAK DETECTOR

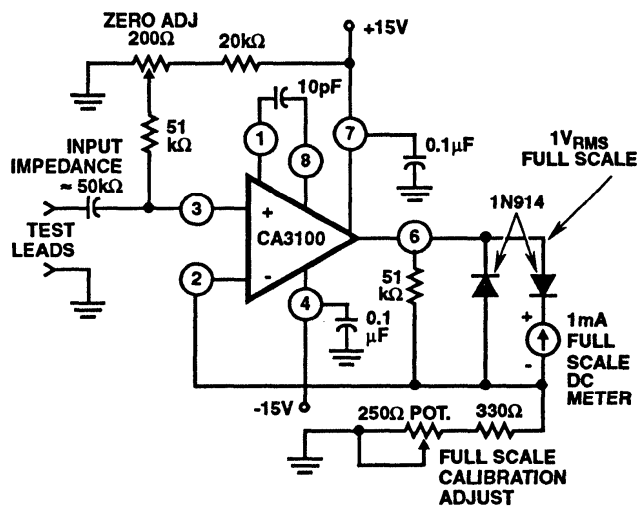


FIGURE 23. 1MHz METER-DRIVE AMPLIFIER