CA3100

Wideband Operational Amplifier

RCA-CA3100S, CA3100T is a large-signal wideband, high-speed operational amplifier which has a unity gain crossover frequency (f_T) of approximately 38 MHz and an open-loop, 3 dB corner frequency of approximately 110 kHz. It can operate at a total supply voltage of from 14 to 36 volts (±7 to ±18 volts when using split supplies) and can provide at least 18 V p-p and 30 mA p-p at the output when operating from ±15 volt supplies. The CA3100 can be compensated with a single external capacitor and has dc offset adjust terminals for those applications requiring offset null. (See Fig. 15).

The CA3100 circuit contains both bipolar and P-MOS transistors on a single monolithic chip.

The CA3100 is supplied in either the standard 8-lead TO-5 package ("T" suffix), or in the 8-lead TO-5 dual-in-line formed-lead "DIL-CAN" package ("S" suffix).

Applications:

- **Video amplifiers**
- **Fast peak detectors**
- **Meter-driver amplifiers**
- **High-frequency feedback amplifiers**
- **Video pre-drivers**
- **Oscillators**
- **Multivibrators**
- **Voltage-controlled oscillator**
- **Fast comparators**

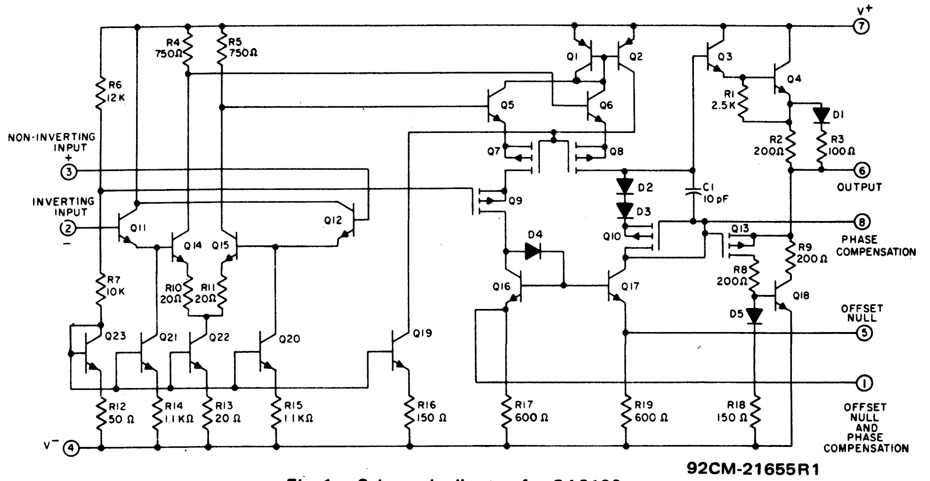

Fig. 1 – Schematic diagram for CA3100.

Features:

- **High open-loop gain at video frequencies – 42 dB typ. at 1 MHz**
- **High unity-gain crossover frequency (f_T) – 38 MHz typ.**
- **Wide power bandwidth – V_O = 18 V p-p typ. at 1.2 MHz**
- **High slew rate – 70 V/μs (typ.) in 20 dB amplifier 25 V/μs (typ.) in unity-gain amplifier**
- **Fast settling time – 0.6 μs typ.**
- **High output current – ±15 mA min.**
- **LM118, 748/LM101 pin compatibility**
- **Single capacitor compensation**
- **Offset null terminals**

MAXIMUM RATINGS, *Absolute-Maximum Values at T_A = 25°C:*

Supply Voltage (between V^+ and V^- terminals) . .	36	V
Differential Input Voltage	±12	V
Input Voltage to Ground*	±15	V
Offset Terminal to V^- Terminal Voltage	±0.5	V
Output Current	50	mA•
Device Dissipation:		
Up to T_A = 55°C	630	mW
Above T_A = 55°C	6.67	mW/°C

Ambient Temperature Range:		
Operating	–55 to +125	°C
Storage	–65 to +150	°C
Lead Temperature (During Soldering):		
At distance 1/16 ± 1/32 inch (1.59 ± 0.79 mm) from case for 10 s max . .	300	°C

*If the supply voltage is less than ±15 volts, the maximum input voltage to ground is equal to the supply voltage.

•CA3100S, CA3100T does not contain circuitry to protect against short circuits in the output.

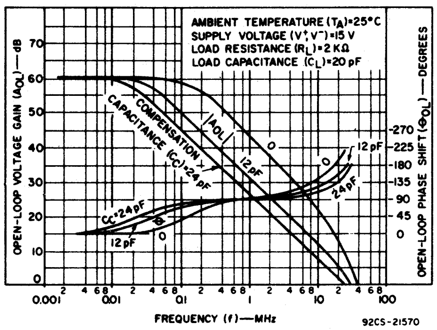

Fig. 2 – Open-loop gain, open-loop phase shift vs. frequency.

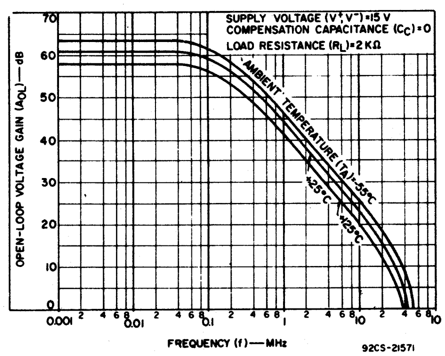

Fig. 3 – Open-loop gain vs. frequency and temperature.

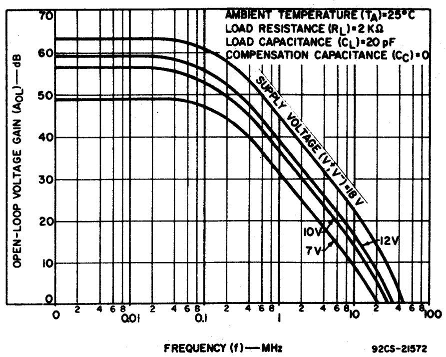

Fig. 4 – Open-loop gain vs. frequency and supply voltage.

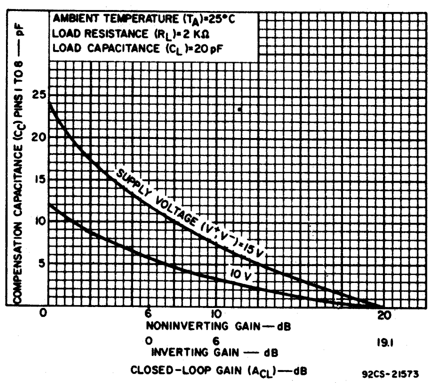

Fig. 5 – Required compensation capacitance vs. closed-loop gain.

CA3100

ELECTRICAL CHARACTERISTICS, *At T_A = 25°C:*

CHARACTERISTICS	TEST CONDITIONS SUPPLY VOLTAGE (V^+,V^-)=15 V UNLESS OTHERWISE SPECIFIED	LIMITS MIN.	TYP.	MAX.	UNITS
STATIC					
Input Offset Voltage, V_{IO}	V_O = 0 ± 0.1 V	–	± 1	± 5	mV
Input Bias Current, I_{IB}	V_O = 0 ± 1 V	–	0.7	2	μA
Input Offset Current, I_{IO}		–	± 0.05	± 0.4	μA
Low-Frequency Open-Loop Voltage Gain, A_{OL} •	V_O = ± 1 V Peak, F = 1 kHz	56	61	–	dB
Common-Mode Input Voltage Range, V_{ICR}	CMRR ≥ 76 dB	± 12	+ 14 −13	–	V
Common-Mode Rejection Ratio, CMRR	V_I Common Mode = ± 12 V	76	90	–	dB
Maximum Output Voltage: Positive, V_{OM}^+	Differential Input Voltage = 0 ± 0.1 V	+9	+11	–	V
Negative, V_{OM}^-	R_L = 2 KΩ	−9	−11	–	
Maximum Output Current: Positive, I_{OM}^+	Differential Input Voltage = 0 ± 0.1 V	+15	+30	–	mA
Negative, I_{OM}^-	R_L = 250 Ω	−15	−30	–	
Supply Current, I^+	V_O = 0 ± 0.1 V, R_L ≥ 10 KΩ	–	8.5	10.5	mA
Power-Supply Rejection Ratio, PSRR	ΔV^+ = ± 1 V, ΔV^- = ± 1 V	60	70	–	dB
DYNAMIC					
Unity-Gain Crossover Frequency, f_T	C_C = 0, V_O = 0.3 V (P-P)	–	38	–	MHz
1-MHz Open-Loop Voltage Gain, A_{OL}	f = 1 MHz, C_C = 0, V_O = 10 V (P-P)	36	42	–	dB
Slew Rate, SR: 20-dB Amplifier	A_V = 10, C_C = 0, V_I = 1 V (Pulse)	50	70	–	V/μs
Follower Mode	A_V = 1, C_C = 10 pF, V_I = 10 V (Pulse)	–	25	–	
Power Bandwidth, PBW▲: 20-dB Amplifier	A_V = 10, C_C = 0, V_O = 18 V (P-P)	0.8	1.2	–	MHz
Follower Mode	A_V = 1, C_C = 10 pF, V_O = 18 V (P-P)	–	0.4	–	
Open-Loop Differential Input Impedance, Z_I	F = 1 MHz	–	30	–	KΩ
Open-Loop Output Impedance, Z_O	F = 1 MHz	–	110	–	Ω
Wideband Noise Voltage Referred to Input, e_N(Total)	BW = 1 MHz, R_S = 1 KΩ	–	8	–	μV_{RMS}
Settling Time, t_s [To Within ± 50 mV of 9 V Output Swing]	R_L = 2 KΩ, C_L = 20 pF	–	0.6	–	μs

▲ Power Bandwidth = $\frac{\text{Slew Rate}}{\pi V_O \text{(P-P)}}$ • Low-frequency dynamic characteristic

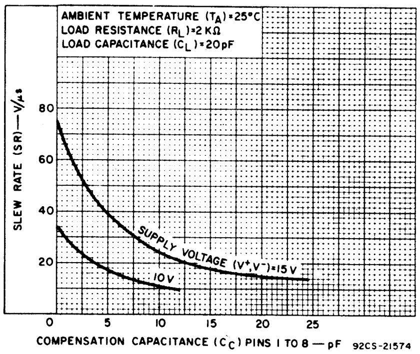

Fig. 6 – Slew rate vs. compensation capacitance.

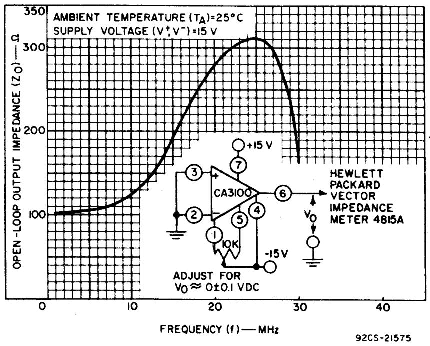

Fig. 7 – Typical open-loop output impedance vs. frequency.

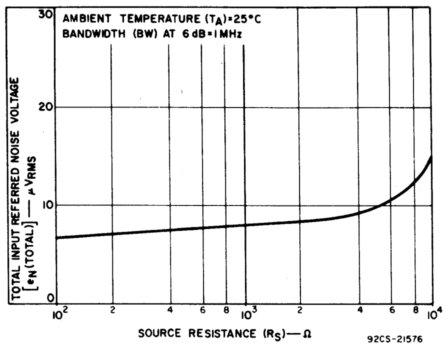

Fig. 8 – Wideband input noise voltage vs. source resistance.

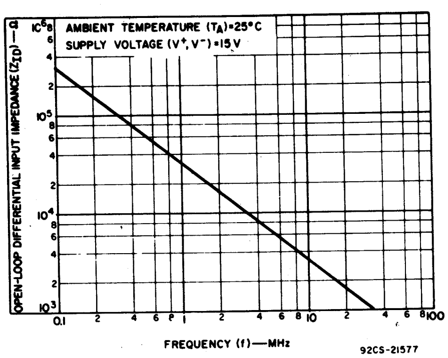

Fig. 9 – Typical open-loop differential input impedance vs. frequency.

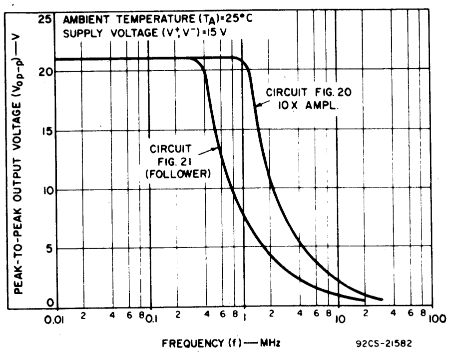

Fig. 10 – Maximum output voltage swing vs. frequency.

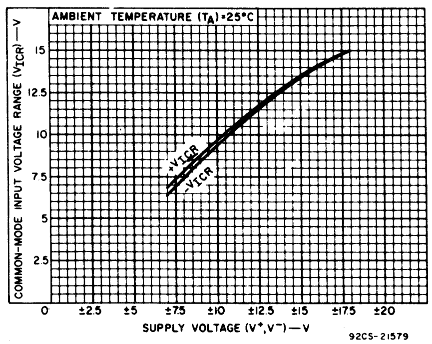

Fig. 11 – Common-mode input voltage range vs. supply voltage.

CA3100

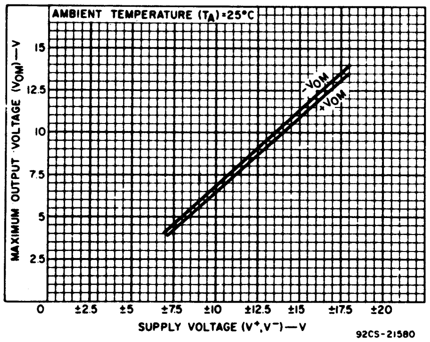

Fig. 12 – Maximum output voltage vs. supply voltage.

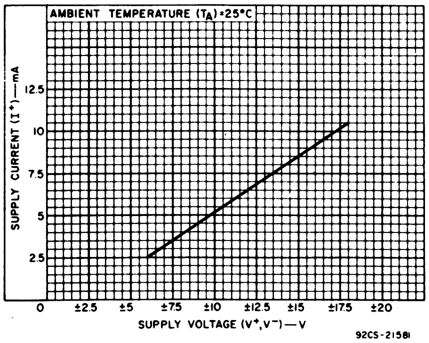

Fig. 13 – Supply current vs. supply voltage.

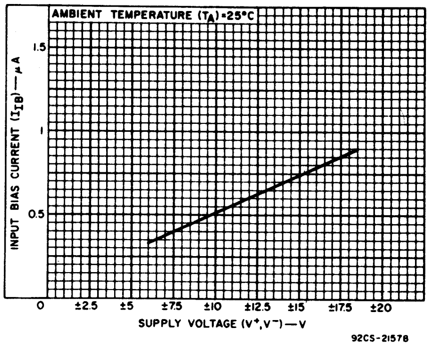

Fig. 14 – Input bias current vs. supply voltage.

TEST CIRCUITS

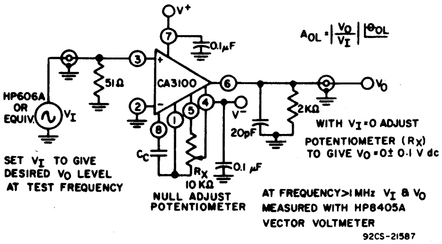

Fig. 15 – Open-loop voltage gain test circuit.

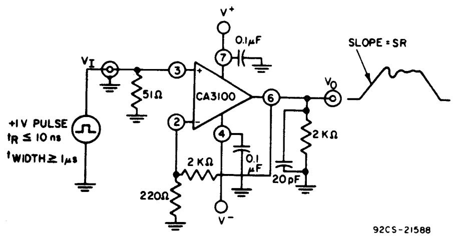

Fig. 16 – Slew rate in 10X amplifier test circuit.

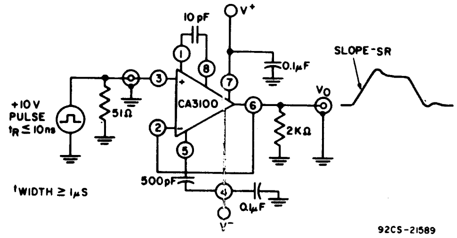

Fig. 17 – Follower slew rate test circuit.

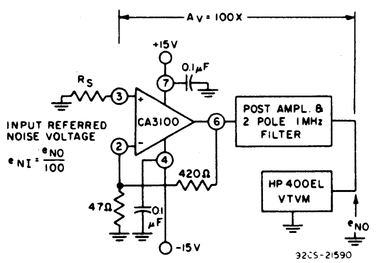

Fig. 18 – Wideband input noise voltage test circuit.

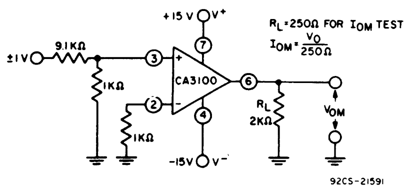

Fig. 19 – Output voltage swing (V_{OM}), output current swing (I_{OM}) test circuit.

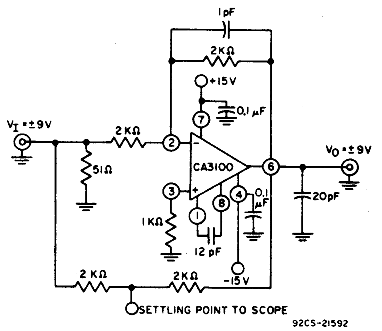

Fig. 20 – Settling time test circuit.

TYPICAL APPLICATIONS

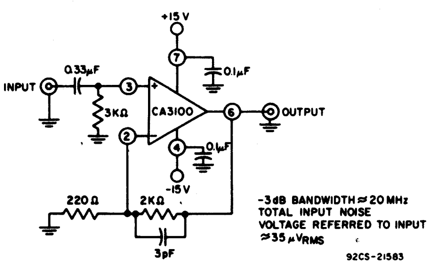

Fig. 21 – 20 dB video amplifier.

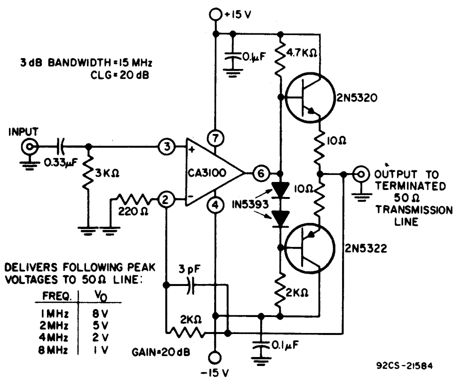

Fig. 22 – 20 dB video line driver.

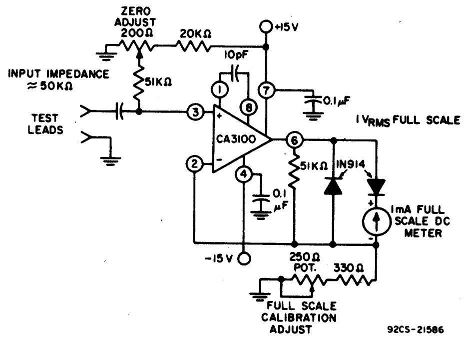

Fig. 23 – 1 MHz meter-driver amplifier.