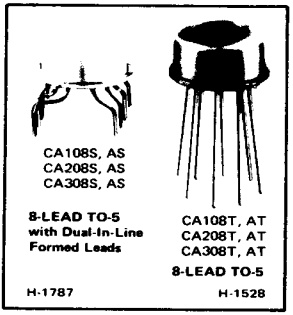
RCA
Solid State Division

Linear Integrated Circuits

Monolithic Silicon

CA108T CA108S CA108AT CA108AS
CA208T CA208S CA208AT CA208AS
CA308T CA308S CA308AT CA308AS



Precision Operational Amplifiers

For Military, Industrial, and Commercial Applications

Features:

- **Maximum input bias current — 2 nA for CA108 & CA208 series**
  7 nA for CA308 series
- **Maximum input offset current — 0.2 nA for CA108 & CA208 series**
  1 nA for CA308 series
- **Supply current of only 300 μA, even in saturation**
- **Maximum input offset voltage of 0.5 mV for "A" suffix types**

RCA-CA108T, CA108AT, CA108S, CA108AS, CA208T, CA208AT, CA208S, CA208AS, CA308T, CA308AT, CA308S, and CA308AS are uncompensated precision operational amplifiers using super-beta transistors and feature very low offset parameters, high input impedance, and defined drift rates with temperature change.

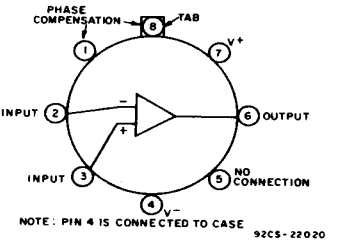
In addition to low drift, these super-beta op-amps have input currents sufficiently low to insure low drift, even when using high source resistances, e.g., 10 megohms.

These devices have sufficient supply rejection to operate from unregulated power supplies within a range of ±2 V to ±20 V, and the input bias current is specifically controlled for use in sample-and-hold applications.

The "A" versions have all the desirable features and characteristics of their prototypes plus exceptionally low input offset voltage characteristics. The CA108, CA108A, CA208, CA208A, CA308, and CA308A are direct replacements for industry types 108,108A,208,208A,308,308A, and they are supplied in either standard 8-lead TO-5 packages or in 8-lead TO-5 packages with dual-in-line formed leads ("DIL-CAN").

Applications:

- **Instrumentation**
- **Summing amplifier**
- **Comparator**
- **Multivibrators**
- **Band-pass filters**
- **Sample and hold**

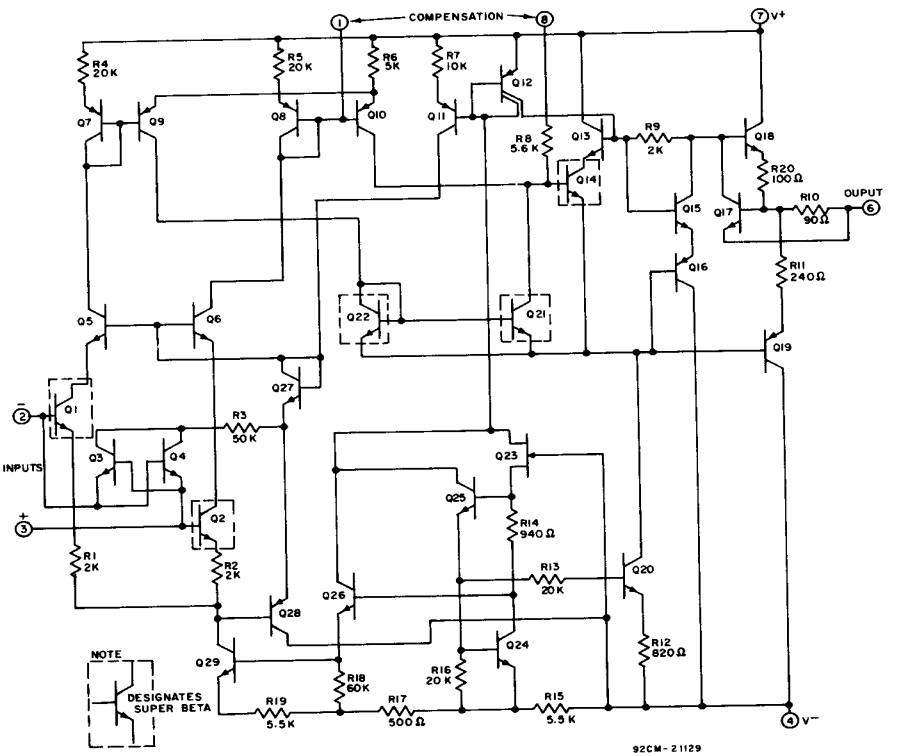


FUNCTIONAL DIAGRAM

ELECTRICAL CHARACTERISTICS, MAXIMUM VALUES AT T_A = 25°C	CA108T CA108S	CA108AT CA108AS	CA208T CA208S	CA208AT CA208AS	CA308T CA308S	CA308AT CA308AS
Input Offset Voltage (V_{IO})	2 mV	0.5 mV	2 mV	0.5 mV	7.5 mV	0.5 mV
Input Offset Current (I_{IO})	0.2 nA				1 nA	
Input Bias Current (I_{IB})	2 nA			7 nA		
Average Temperature Coefficient of Input Offset Voltage ($\Delta V_{IO}/\Delta T$)	15 μV/°C	5 μV/°C	15 μV/°C	5 μV/°C	30 μV/°C	5 μV/°C
Ambient Operating-Temperature Range	−55 to +125°C		−25 to +85°C		0 to +70°C	

Maximum Ratings, *Absolute-Maximum Values at $T_A = 25^oC$:*

DC Supply Voltage (Between V^+ and V^- Terminals):	
CA108, CA108A, CA208, CA208A	40 V
CA308, CA308A	36 V
DC Input Voltage	±15 V
(For supply voltages less than ± 15 V, the absolute maximum input voltage is equal to the supply voltage)	
Differential Input Current	±10 mA
Output Short-Circuit Duration	Indefinite
Device Dissipation	500 mW
Ambient Temperature Range:	
Operating – CA108, CA108A	−55°C to +125°C
CA208, CA208A	−25°C to +85°C
CA308, CA308A	0°C to +70°C
Storage – All Types	−65°C to +150°C
Lead Temperature (During Soldering):	
At distance 1/16 ± 1/32 inch (1.59 ± 0.79 mm) from case for 10 seconds max.	+300 °C



ELECTRICAL CHARACTERISTICS

CHARACTERISTICS	SYMBOL	TEST CONDITIONS FIG. No.	TEST CONDITIONS Supply Voltage (V) = ±5 V to ±15 V	LIMITS CA108 CA208 Min.	CA108 CA208 Typ.	CA108 CA208 Max.	CA108A CA208A Min.	CA108A CA208A Typ.	CA108A CA208A Max.	CA308 Min.	CA308 Typ.	CA308 Max.	CA308A Min.	CA308A Typ.	CA308A Max.	UNITS
Input Offset Voltage	V_{IO}	6,7	T_A = 25°C	–	0.7	2	–	0.3	0.5	–	2	7.5	–	0.3	0.5	mV
			Note 1	–	–	3	–	–	1	–	–	10	–	–	0.73	
Average Temperature Coefficient of Input Offset Voltage	$\frac{\Delta V_{IO}}{\Delta T}$		Note 1	–	3	15	–	1	5	–	6	30	–	1	5	μV/°C
Input Offset Current	I_{IO}	8,9	Note 1	–	–	0.4	–	–	0.4	–	–	1.5	–	–	1.5	nA
			T_A = 25°C	–	0.05	0.2	–	0.05	0.2	–	0.2	1	–	0.2	1	
Average Temperature Coefficient of Input Offset Current	$\frac{\Delta I_{IO}}{\Delta T}$		Note 1	–	0.5	2.5	–	0.5	2.5	–	2	10	–	2	10	pA/°C
Input Bias Current	I_{IB}	10, 11	Note 1	–	–	3	–	–	3	–	–	10	–	–	10	nA
			T_A = 25°C	–	0.8	2	–	0.8	2	–	1.5	7	–	1.5	7	
Supply Current	I_Q	12, 13	T_A = +125°C	–	0.15	0.4	–	0.15	0.4	–	–	–	–	–	–	mA
			T_A = 25°C	–	0.3	0.6	–	0.3	0.6	–	0.3	0.8	–	0.3	0.8	
Large-Signal Voltage Gain	A_V	2,14 15	V = ±15 V, T_A = 25°C V_O = ±10 V, $R_L \geq$ 10 kΩ	50	300	–	80	300	–	25	300	–	80	300	–	V/mV
			V = ±15 V, V_O = ±10 V $R_L \geq$ 10 kΩ, Note 1	25	–	–	40	–	–	15	–	–	60	–	–	
Input Resistance	R_I		T_A = 25°C	30	70	–	30	70	–	10	40	–	10	40	–	MΩ
Output Voltage	V_O	16, 17	V = ±15 V, R_L = 10 kΩ, Note 1	±13	±14	–	±13	±14	–	±13	±14	–	±13	±14	–	V
Input Voltage Range	V_I		V = ±15 V, Note 1	±13.5	–	–	±13.5	–	–	±14	–	–	±14	–	–	
Common-Mode Rejection Ratio	CMRR		Note 1	85	100	–	96	110	–	80	100	–	96	110	–	dB
Supply-Voltage Rejection Ratio	V_{RR}		Note 1	80	96	–	96	110	–	80	96	–	96	110	–	

Note 1: Ambient Temperature (T_A) over applicable operating temperature range as shown below unless otherwise specified.

CA108 CA108A	CA208 CA208A	CA308 CA308A
−55 to +125°C	−25 to +85°C	0 to +70°C

TEST CIRCUITS

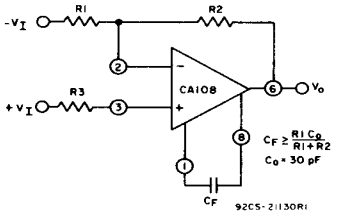


Fig. 2—Standard frequency-compensation.

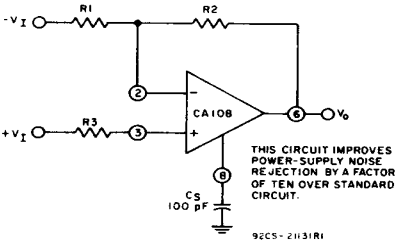


Fig. 3—Alternate frequency-compensation.

TYPICAL APPLICATIONS

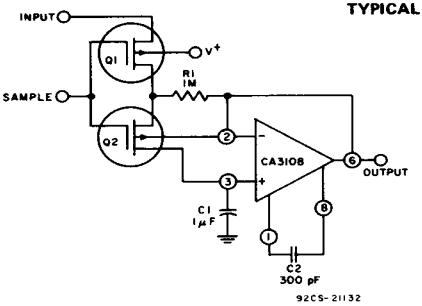


Fig. 4 — Sample-and-hold circuit.

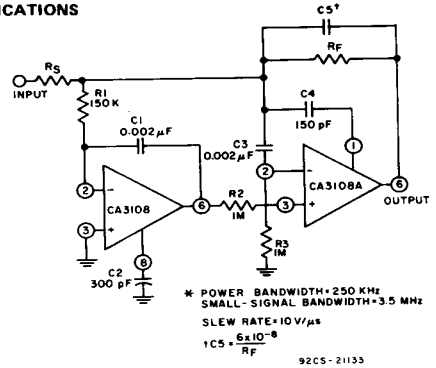


Fig. 5 — Fast* summing amplifier circuit.

CHARACTERISTIC CURVES

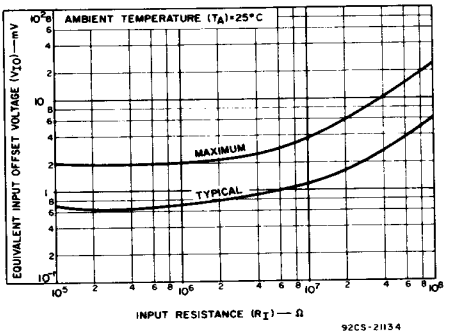


Fig. 6 — Input offset error for CA108, CA108A, CA208, and CA208A.

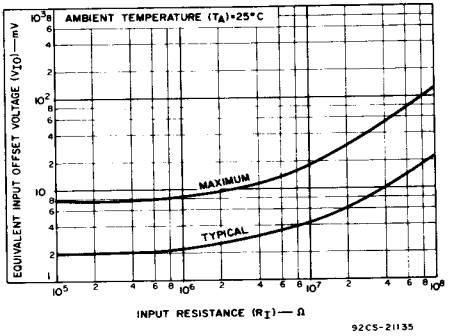


Fig. 7 — Input offset error for CA308 and CA308A.

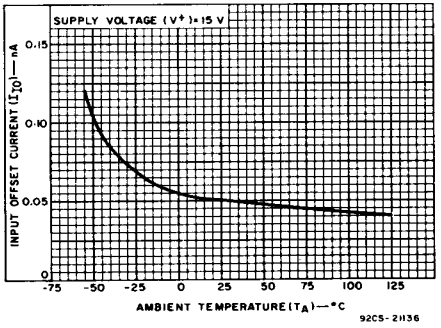


Fig. 8 — Input offset current vs. temperature for CA108, CA108A, CA208, and CA208A.

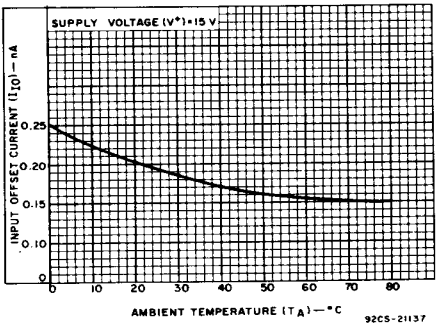


Fig. 9 — Input offset current vs. temperature for CA308 and CA308A.

CHARACTERISTIC CURVES (Cont'd)

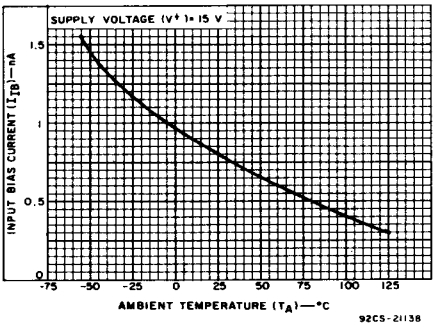


Fig. 10 – Input bias current vs. temperature for CA108, CA108A, CA208, and CA208A.

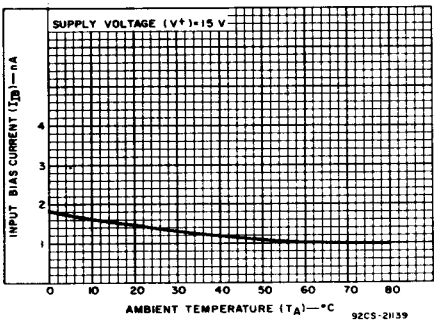


Fig. 11 – Input bias current vs. temperature for CA308 and CA308A.

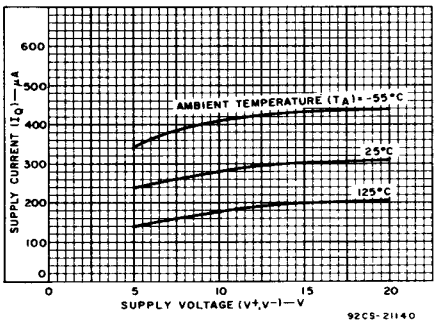


Fig. 12 – Supply current vs. supply voltage for CA108, CA108A, CA208, and CA208A.

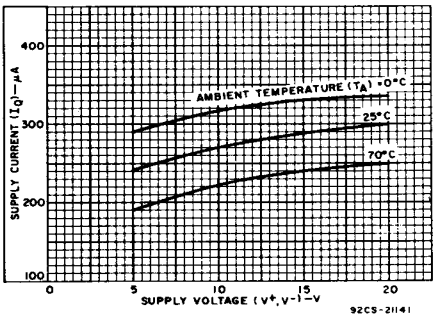


Fig. 13 – Supply current vs. supply voltage for CA308 CA308A.

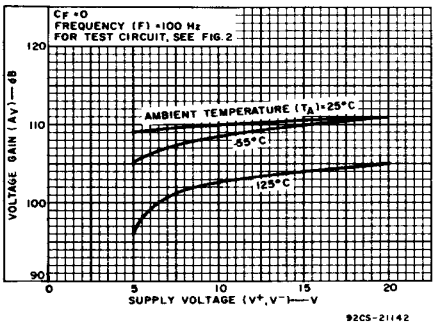


Fig. 14 – Voltage gain vs. supply voltage for CA108, CA108A, CA208, and CA208A.

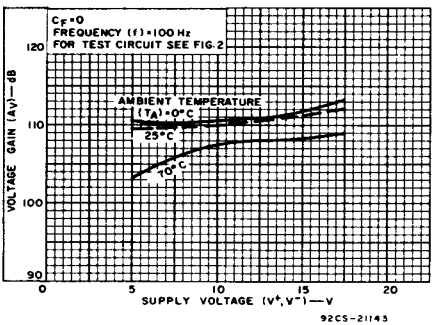


Fig. 15 – Voltage gain vs. supply voltage for CA308 and CA308A.

CHARACTERISTIC CURVES (Cont'd)

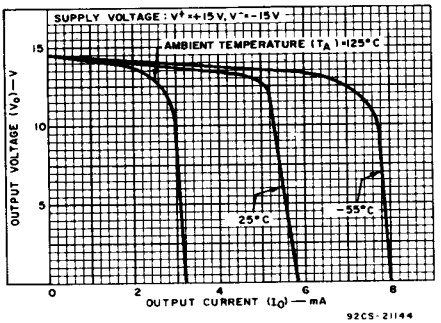


Fig. 16 – Output voltage vs. output current for CA108, CA108A, CA208, and CA208A.

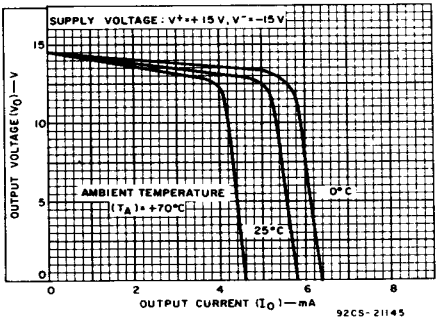


Fig. 17 – Output voltage vs. output current for CA308 and CA308A.

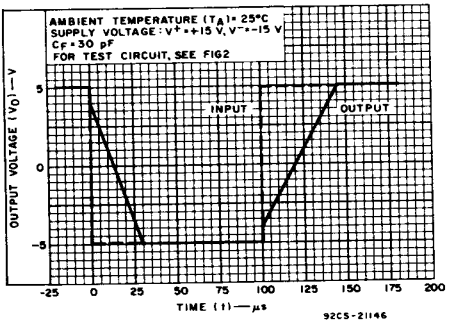


Fig. 18 – Voltage-follower pulse response for all types.

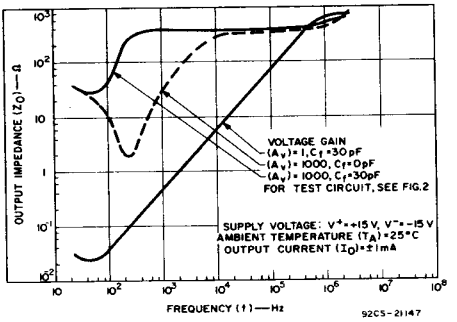


Fig. 19 – Closed-loop output impedance for all types.

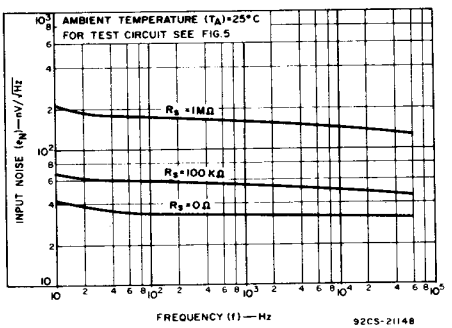


Fig. 20 – Input noise voltage for all types.

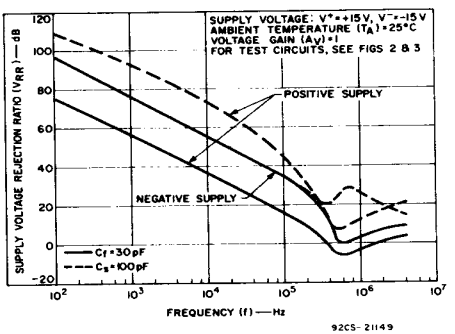


Fig. 21 – Power-supply rejection for all types.

CHARACTERISTIC CURVES (Cont'd)

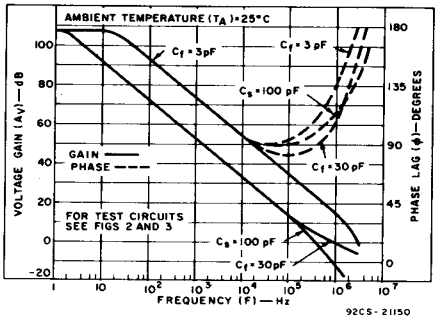


Fig. 22 – Open-loop frequency response for all types.

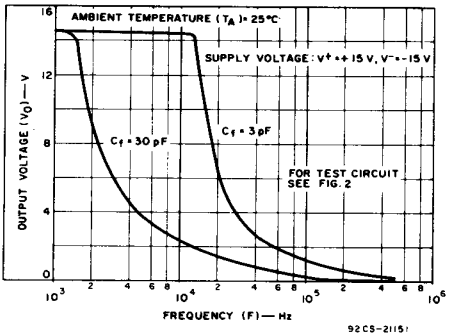


Fig. 23 – Large-signal frequency response for all types.

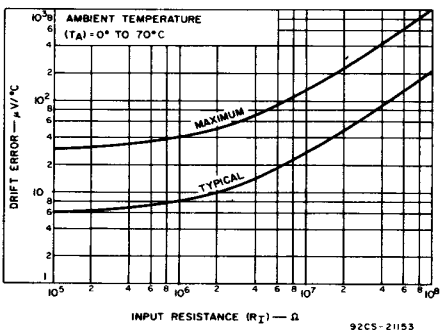


Fig. 24 – Drift error vs. input resistance for CA108, CA108A, CA208, and CA208A.

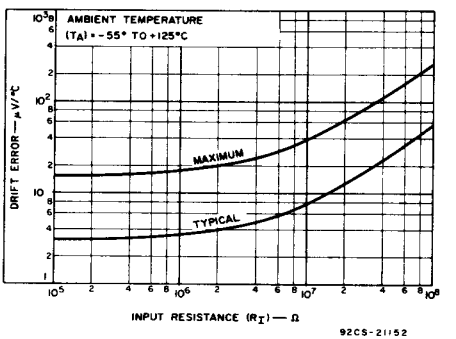


Fig. 25 – Drift error vs. input resistance for CA308 and CA308A.