Rochester Electronics

Datasheet

CA3080A

2MHz, Operational Transconductance Amplifier (OTA)

The CA3080 and CA3080A types are GatabLe-Gain Blocks which utilize the unique operational transconductance amplifier (OTA) concept described in Application Note AN6668, "Applications of the CA3080 and CA3080A High-Performance Operational Transconductance Amplifiers".

The CA3080 and CA3080A types have differential input and a single-ended, push-pull, class A output. In addition, these types have an amplifier bias input which may be used either for gating or for linear gain control. These types also have a high output impedance and their transconductance (g_M) is directly proportional to the amplifier bias current (I_{ABC}).

Rochester Electronics Manufactured Components

Rochester branded components are manufactured using either die/wafers purchased from the original suppliers or Rochester wafers recreated from the original IP. All re-creations are done with the approval of the Original Component Manufacturer (OCM).

Parts are tested using original factory test programs or Rochester developed test solutions to guarantee product meets or exceeds the OCM data sheet.

Quality Overview

- ISO-9001
- AS9120 certification
- Qualified Manufacturers List (QML) MIL-PRF-35835
  - Class Q Military
  - Class V Space Level
- Qualified Suppliers List of Distributors (QSLD)
  - Rochester is a critical supplier to DLA and meets all industry and DLA standards.

Rochester Electronics, LLC is committed to supplying products that satisfy customer expectations for quality and are equal to those originally supplied by industry manufacturers.

The original manufacturer's datasheet accompanying this document reflects the performance and specifications of the Rochester manufactured version of this device. Rochester Electronics guarantees the performance of its semiconductor products to the original OCM specifications. 'Typical' values are for reference purposes only. Certain minimum or maximum ratings may be based on product characterization, design, simulation, or sample testing.

FOR REFERENCE ONLY

HARRIS SEMICONDUCTOR

CA3080, CA3080A

2MHz, Operational Transconductance Amplifier (OTA)

November 1996

Features

- **Slew Rate (Unity Gain, Compensated). 50V/µs**
- **Adjustable Power Consumption . . . . 10µW to 30µW**
- **Flexible Supply Voltage Range . . . . ±2V to ±15V**
- **Fully Adjustable Gain . . . . 0 to $g_M R_L$ Limit**
- **Tight g_M Spread:**
  - **CA3080 . . . . 2:1**
  - **CA3080A 1.6:1**
- **Extended g_M Linearity . . . . 3 Decades**

Applications

- **Sample and Hold**
- **Multiplexer**
- **Voltage Follower**
- **Multiplier**
- **Comparator**

Ordering Information

PART NUMBER (BRAND)	TEMP. RANGE (°C)	PACKAGE	PKG. NO.
CA3080	0 to 70	8 Pin Metal Can	T8.C
CA3080A	-55 to 125	8 Pin Metal Can	T8.C
CA3080AE	-55 to 125	8 Ld PDIP	E8.3
CA3080AM (3080A)	-55 to 125	8 Ld SOIC	M8.15
CA3080AM96 (3080A)	-55 to 125	8 Ld SOIC Tape and Reel	M8.15
CA3080E	0 to 70	8 Ld PDIP	E8.3
CA3080M (3080)	0 to 70	8 Ld SOIC	M8.15
CA3080M96 (3080)	0 to 70	8 Ld SOIC Tape and Reel	M8.15

Description

The CA3080 and CA3080A types are Gatable-Gain Blocks which utilize the unique operational-transconductance-amplifier (OTA) concept described in Application Note AN6668, "Applications of the CA3080 and CA3080A High-Performance Operational Transconductance Amplifiers".

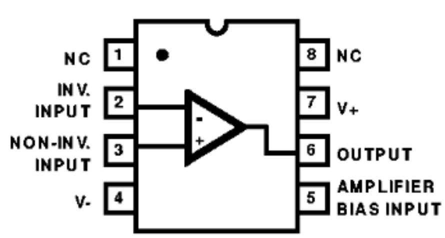
The CA3080 and CA3080A types have differential input and a single-ended, push-pull, class A output. In addition, these types have an amplifier bias input which may be used either for gating or for linear gain control. These types also have a high output impedance and their transconductance (g_M) is directly proportional to the amplifier bias current (I_{ABC}).

The CA3080 and CA3080A types are notable for their excellent slew rate (50V/µs), which makes them especially useful for multiplexer and fast unity-gain voltage followers. These types are especially applicable for multiplexer applications because power is consumed only when the devices are in the "ON" channel state.

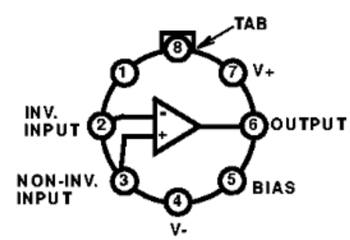
The CA3080A's characteristics are specifically controlled for applications such as sample-hold, gain-control, multiplexing, etc.

Pinouts

CA3080 (PDIP, SOIC)
TOP VIEW



CA3080 (METAL CAN)
TOP VIEW



NOTE: Pin 4 is connected to case.

CAUTION: These devices are sensitive to electrostatic discharge. Users should follow proper IC Handling Procedures.

Absolute Maximum Ratings

Supply Voltage (Between V+ and V- Terminal) 36V
Differential Input Voltage 5V
Input Voltage . . . . V+ to V-
Input Signal Current 1mA
Amplifier Bias Current (I_{ABC}) 2mA
Output Short Circuit Duration (Note 1) . . . . No Limitation

Operating Conditions

Temperature Range
CA3080 . . . . 0^oC to 70^oC
CA3080A . . . . -55^oC to 125^oC

Thermal Information

Thermal Resistance (Typical, Note 2)	θ_{JA} ($^oC/W$)	θ_{JC} ($^oC/W$)
PDIP Package	130	N/A
SOIC Package	170	N/A
Metal Can Package	200	120

Maximum Junction Temperature (Metal Can) . . . . 175^oC
Maximum Junction Temperature (Plastic Package) . . . . 150^oC
Maximum Storage Temperature Range . . . . -65^oC to 150^oC
Maximum Lead Temperature (Soldering 10s) . . . . 300^oC
(SOIC - Lead Tips Only)

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.

NOTES:

1. Short circuit may be applied to ground or to either supply.
2. θ_{JA} is measured with the component mounted on an evaluation PC board in free air.

Electrical Specifications

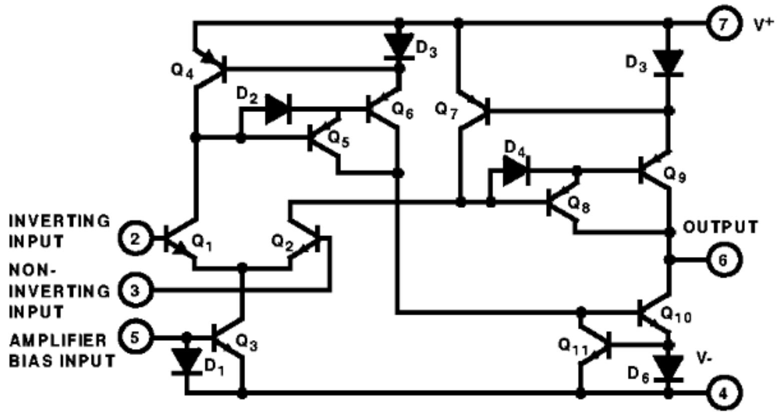
For Equipment Design, $V_{SUPPLY} = \pm15V$, Unless Otherwise Specified

PARAMETER		TEST CONDITIONS	TEMP	CA3080 MIN	CA3080 TYP	CA3080 MAX	CA3080A MIN	CA3080A TYP	CA3080A MAX	UNITS
Input Offset Voltage		$I_{ABC} = 5\mu A$	25	-	0.3	-	-	0.3	2	mV
		$I_{ABC} = 500\mu A$	25	-	0.4	5	-	0.4	2	mV
			Full	-	-	6	-	-	5	mV
Input Offset Voltage Change		$I_{ABC} = 500\mu A$ to $5\mu A$	25	-	0.2	-	-	0.1	3	mV
Input Offset Voltage Temp. Drift		$I_{ABC} = 100\mu A$	Full	-	-	-	-	3.0	-	$\mu V/^oC$
Input Offset Voltage Sensitivity	Positive	$I_{ABC} = 500\mu A$	25	-	-	150	-	-	150	$\mu V/V$
	Negative		25	-	-	150	-	-	150	$\mu V/V$
Input Offset Current		$I_{ABC} = 500\mu A$	25	-	0.12	0.6	-	0.12	0.6	μA
Input Bias Current		$I_{ABC} = 500\mu A$	25	-	2	5	-	2	5	μA
			Full	-	-	7	-	-	15	μA
Differential Input Current		$I_{ABC} = 0$, $V_{DIFF} = 4V$	25	-	0.008	-	-	0.008	5	nA
Amplifier Bias Voltage		$I_{ABC} = 500\mu A$	25	-	0.71	-	-	0.71	-	V
Input Resistance		$I_{ABC} = 500\mu A$	25	10	26	-	10	26	-	kΩ
Input Capacitance		$I_{ABC} = 500\mu A$, f = 1MHz	25	-	3.6	-	-	3.6	-	pF
Input-to-Output Capacitance		$I_{ABC} = 500\mu A$, f = 1MHz	25	-	0.024	-	-	0.024	-	pF
Common-Mode Input-Voltage Range		$I_{ABC} = 500\mu A$	25	12 to -12	13.6 to -14.6	-	12 to -12	13.6 to -14.6	-	V
Forward Transconductance (Large Signal)		$I_{ABC} = 500\mu A$	25	6700	9600	13000	7700	9600	12000	μS
			Full	5400	-	-	4000	-	-	μS
Output Capacitance		$I_{ABC} = 500\mu A$, f = 1MHz	25	-	5.6	-	-	5.6	-	pF
Output Resistance		$I_{ABC} = 500\mu A$	25	-	15	-	-	15	-	MΩ
Peak Output Current		$I_{ABC} = 5\mu A$, $R_L = 0\Omega$	25	-	5	-	3	5	7	μA
		$I_{ABC} = 500\mu A$, $R_L = 0\Omega$	25	350	500	650	350	500	650	μA
			Full	300	-	-	300	-	-	μA

Electrical Specifications For Equipment Design, V_{SUPPLY} = ±15V, Unless Otherwise Specified **(Continued)**

PARAMETER		TEST CONDITIONS	TEMP	CA3080 MIN	CA3080 TYP	CA3080 MAX	CA3080A MIN	CA3080A TYP	CA3080A MAX	UNITS
Peak Output Voltage	Positive	I_{ABC} = 5µA, R_L = ∞	25	-	13.8	-	12	13.8	-	V
	Negative		25	-	-14.5	-	-12	-14.5	-	V
	Positive	I_{ABC} = 500µA, R_L = ∞	25	12	13.5	-	12	13.5	-	V
	Negative		25	-12	-14.4	-	-12	-14.4	-	V
Amplifier Supply Current		I_{ABC} = 500µA	25	0.8	1	1.2	0.8	1	1.2	mA
Device Dissipation		I_{ABC} = 500µA	25	24	30	36	24	30	36	mW
Magnitude of Leakage Current		I_{ABC} = 0, V_{TP} = 0	25	-	0.08	-	-	0.08	5	nA
		I_{ABC} = 0, V_{TP} = 36V	25	-	0.3	-	-	0.3	5	nA
Propagation Delay		I_{ABC} = 500µA	25	-	45	-	-	45	-	ns
Common-Mode Rejection Ratio		I_{ABC} = 500µA	25	80	110	-	80	110	-	dB
Open-Loop Bandwidth		I_{ABC} = 500µA	25	-	2	-	-	2	-	MHz
Slew Rate		Uncompensated	25	-	75	-	-	75	-	V/µs
		Compensated	25	-	50	-	-	50	-	V/µs

Schematic Diagram



Typical Applications

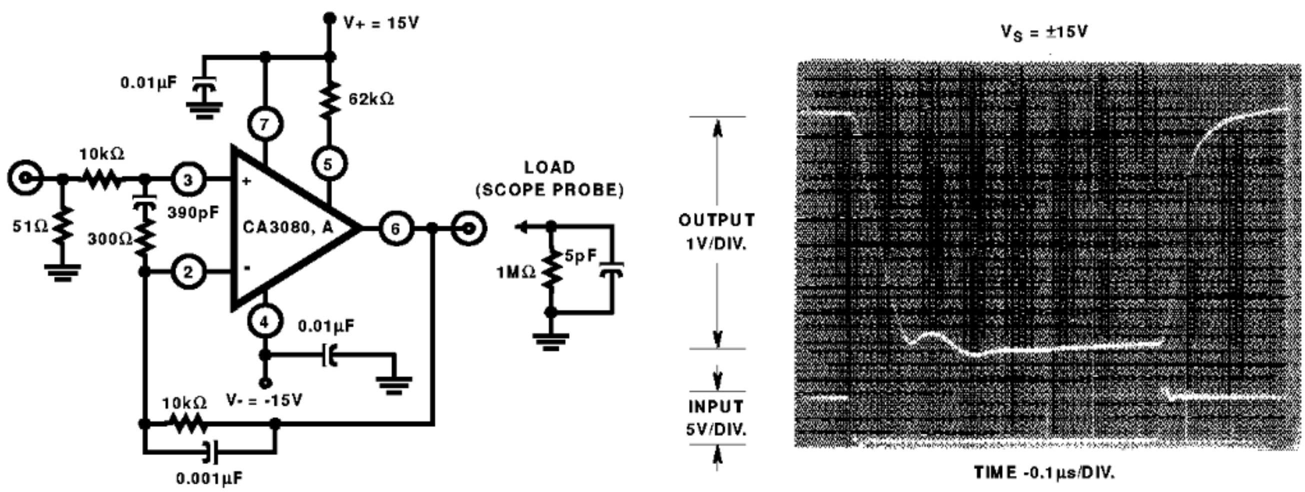


FIGURE 1. SCHEMATIC DIAGRAM OF THE CA3080 AND CA3080A IN A UNITY-GAIN VOLTAGE FOLLOWER CONFIGURATION AND ASSOCIATED WAVEFORM

Typical Applications (Continued)

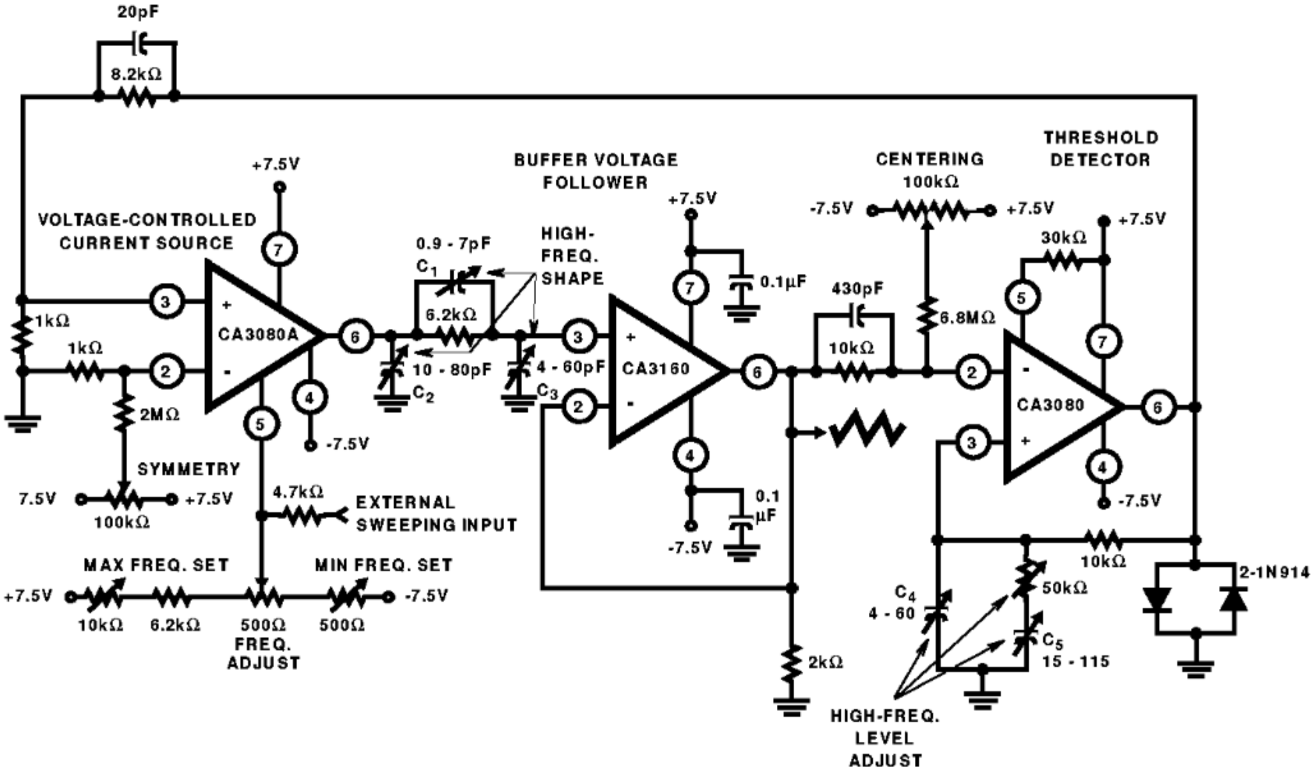
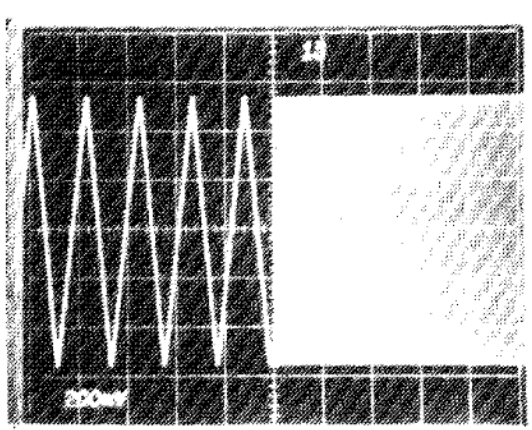
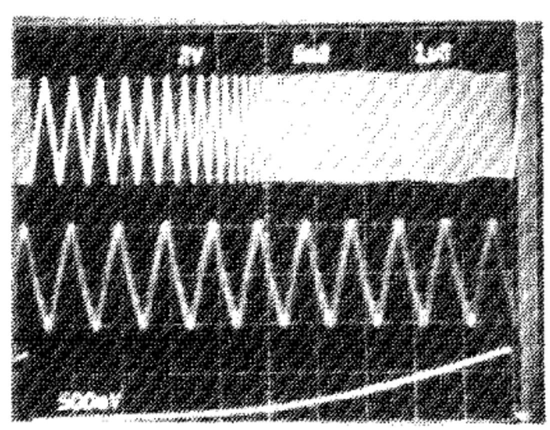


FIGURE 2. 1,000,000/1 SINGLE-CONTROL FUNCTION GENERATOR - 1MHz TO 1Hz



NOTE: A Square-Wave Signal Modulates The External Sweeping Input to Produce 1Hz and 1MHz, showing the 1,000,000/1 frequency range of the function generator.

FIGURE 3A. TWO-TONE OUTPUT SIGNAL FROM THE FUNCTION GENERATOR

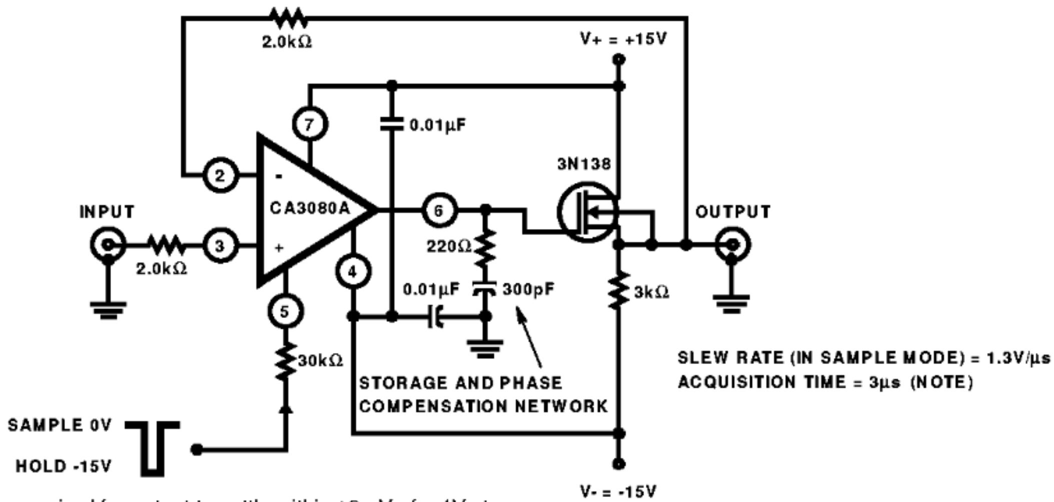


NOTE: The bottom trace is the sweeping signal and the top trace is the actual generator output. The center trace displays the 1MHz signal via delayed oscilloscope triggering of the upper swept output signal.

FIGURE 3B. TRIPLE-TRACE OF THE FUNCTION GENERATOR SWEEPING TO 1MHz

FIGURE 3. FUNCTION GENERATOR DYNAMIC CHARACTERISTICS WAVEFORMS

Typical Applications (Continued)



NOTE: Time required for output to settle within ±3mV of a 4V step.

FIGURE 4. SCHEMATIC DIAGRAM OF THE CA3080A IN A SAMPLE-HOLD CONFIGURATION

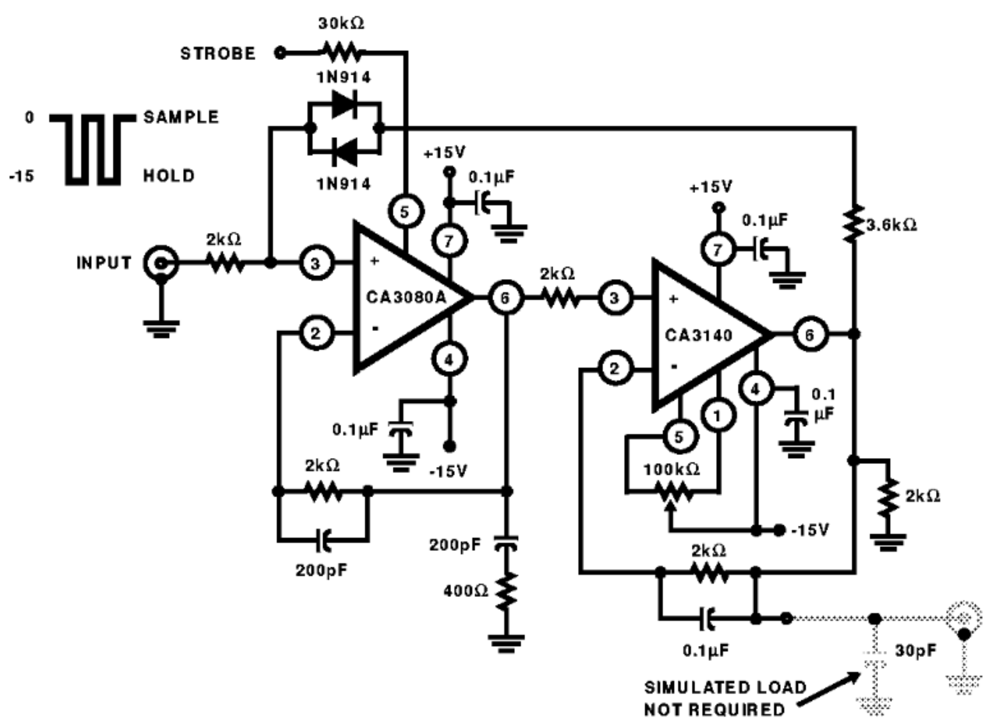
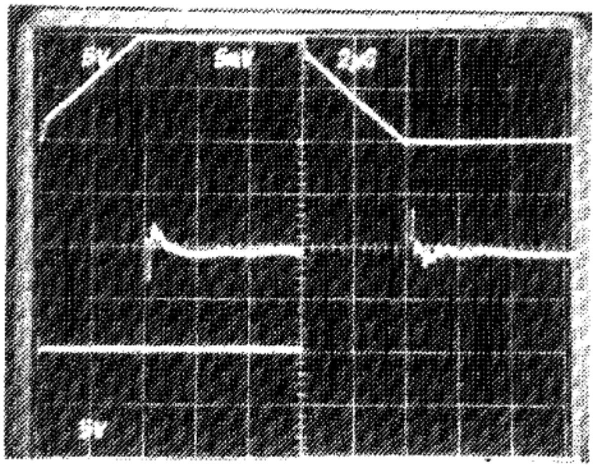


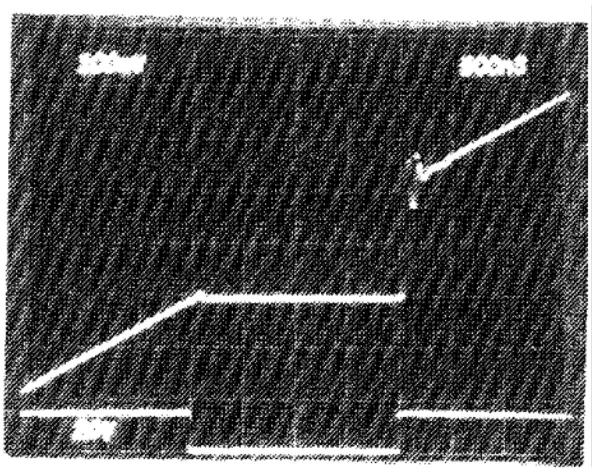
FIGURE 5. SAMPLE AND HOLD CIRCUIT

Typical Applications (Continued)



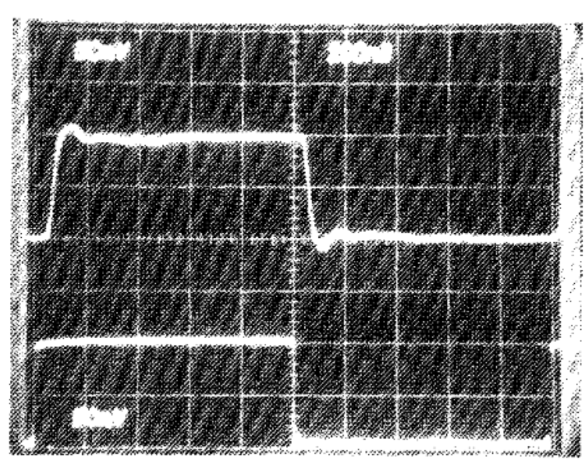
Top Trace:	Output Signal 5V/Div., 2µs/Div.
Bottom Trace:	Input Signal 5V/Div., 2µs/Div.
Center Trace:	Difference of Input and Output Signals Through Tektronix Amplifier 7A13 5mV/Div., 2µs/Div.

FIGURE 6. LARGE SIGNAL RESPONSE AND SETTLING TIME FOR CIRCUIT SHOWN IN FIGURE 23



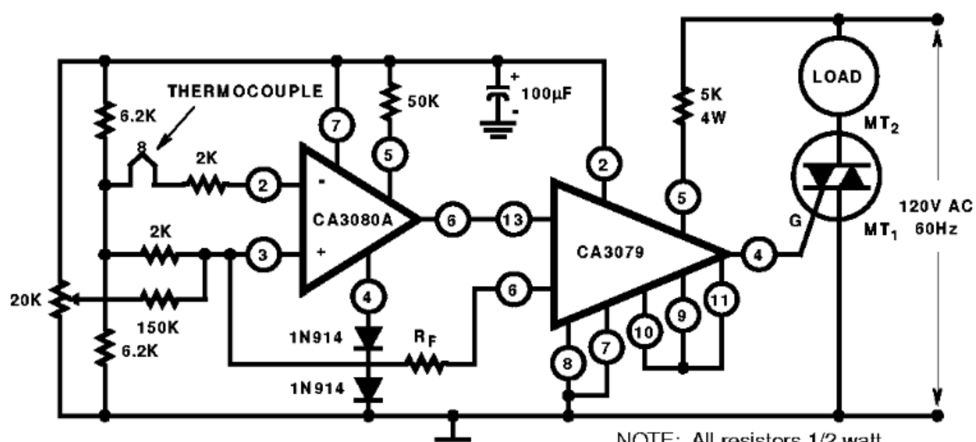
Top Trace: System Output; 100mV/Div., 500ns/Div.
Bottom Trace: Sampling Signal; 20V/Div., 500ns/Div.

FIGURE 7. SAMPLING RESPONSE FOR CIRCUIT SHOWN IN FIGURE 23



Top Trace: Output; 50mV/Div., 200ns/Div.
Bottom Trace: Input; 50mV/Div., 200ns/Div.

FIGURE 8. INPUT AND OUTPUT RESPONSE FOR CIRCUIT SHOWN IN FIGURE 23



NOTE: All resistors 1/2 watt, unless otherwise specified.

FIGURE 9. THERMOCOUPLE TEMPERATURE CONTROL WITH CA3079 ZERO VOLTAGE SWITCH AS THE OUTPUT AMPLIFIER

Typical Applications (Continued)

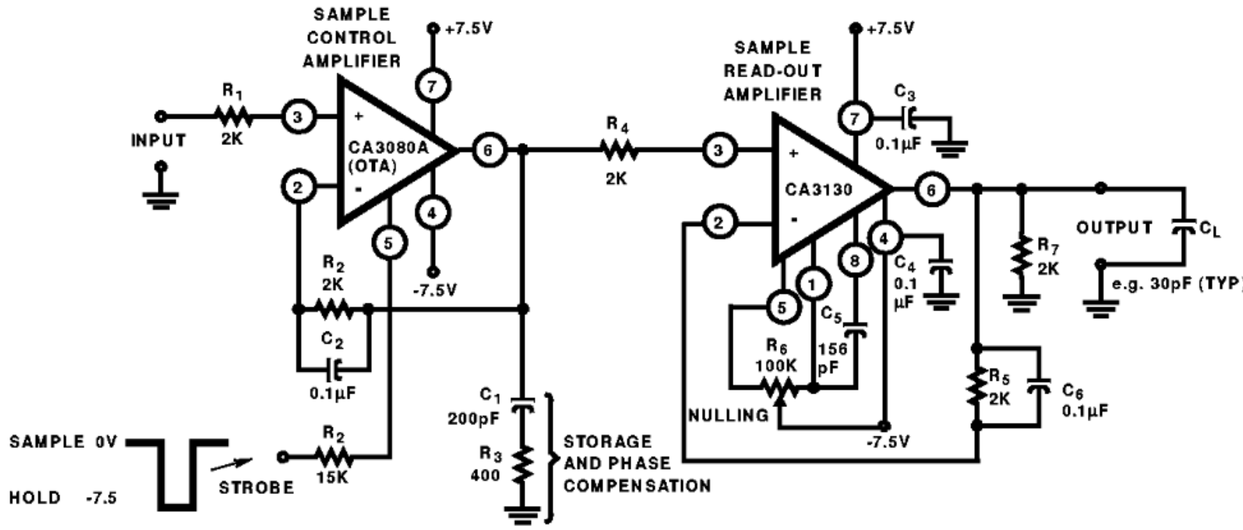
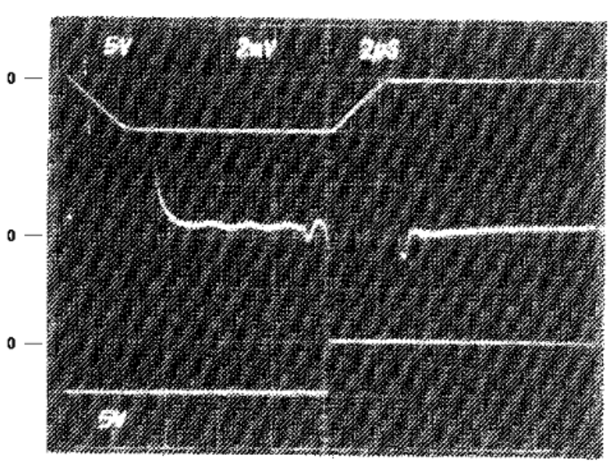
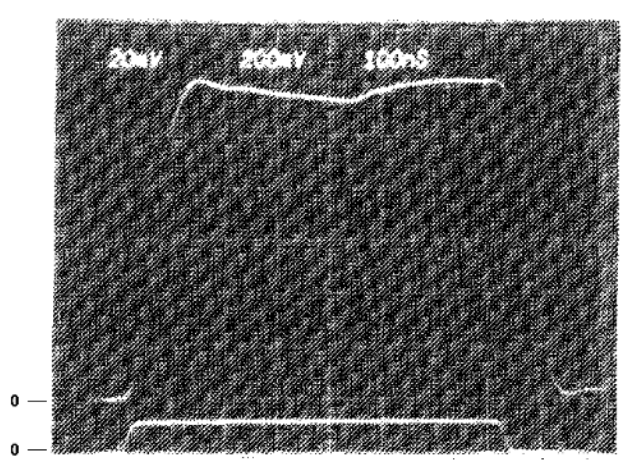


FIGURE 10. SCHEMATIC DIAGRAM OF THE CA3080A IN A SAMPLE-HOLD CIRCUIT WITH BIMOS OUTPUT AMPLIFIER



Top Trace: Output; 5V/Div., 2µs/Div.
Center Trace: Differential Comparison of Input and Output 2mV/Div., 2µs/Div.
Bottom Trace: Input; 5V/Div., 2µs/Div.

FIGURE 11. LARGE-SIGNAL RESPONSE FOR CIRCUIT SHOWN IN FIGURE 28



Top Trace: Output 20mV/Div., 100ns/Div.
Bottom Trace: Input 200mV/Div., 100ns/Div.

FIGURE 12. SMALL-SIGNAL RESPONSE FOR CIRCUIT SHOWN IN FIGURE 28

Typical Applications (Continued)

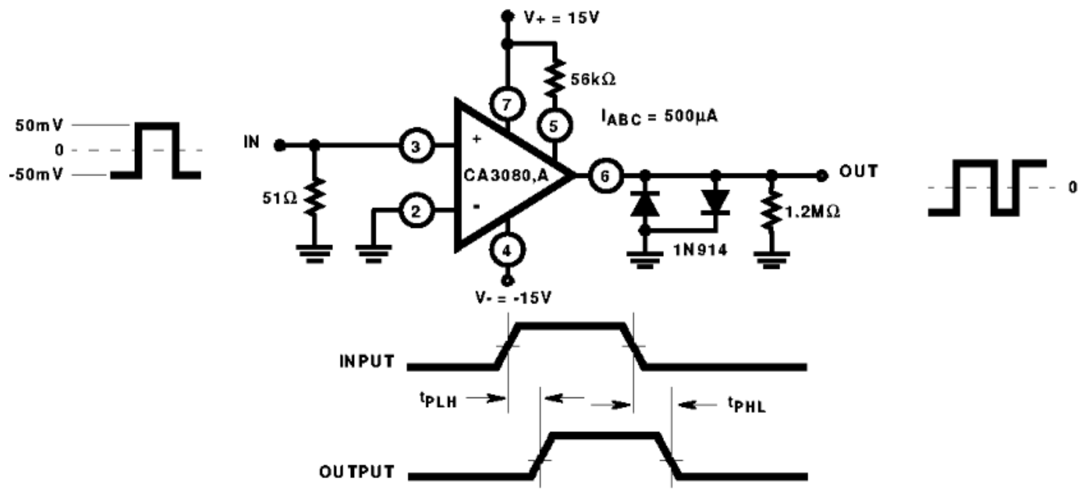


FIGURE 13. PROPAGATION DELAY TEST CIRCUIT AND ASSOCIATED WAVEFORMS

Typical Performance Curves

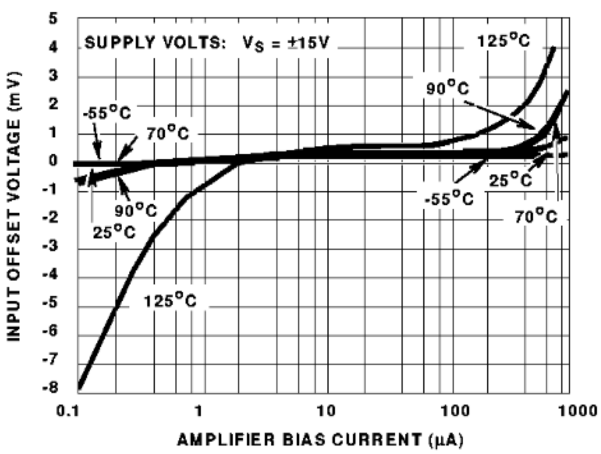


FIGURE 14. INPUT OFFSET VOLTAGE vs AMPLIFIER BIAS CURRENT

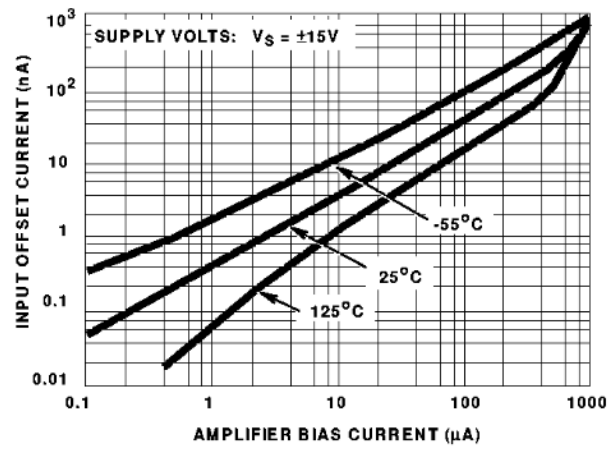


FIGURE 15. INPUT OFFSET CURRENT vs AMPLIFIER BIAS CURRENT

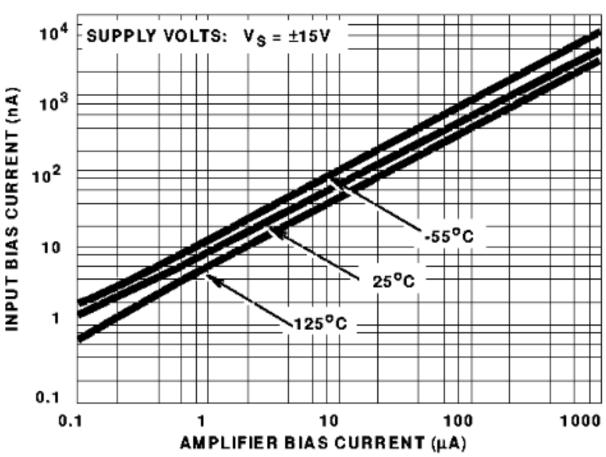


FIGURE 16. INPUT BIAS CURRENT vs AMPLIFIER BIAS CURRENT

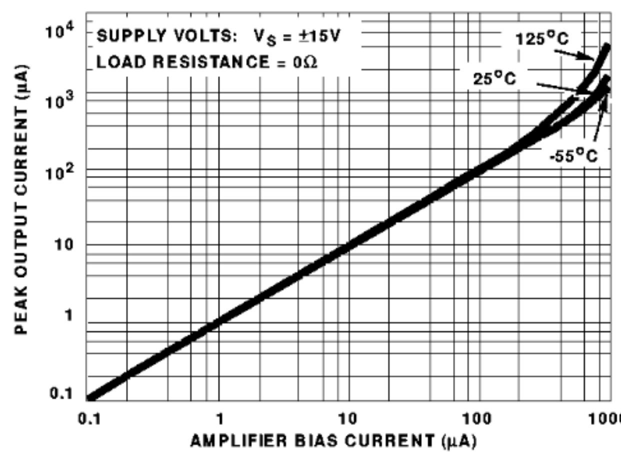


FIGURE 17. PEAK OUTPUT CURRENT vs AMPLIFIER BIAS CURRENT

Typical Performance Curves (Continued)

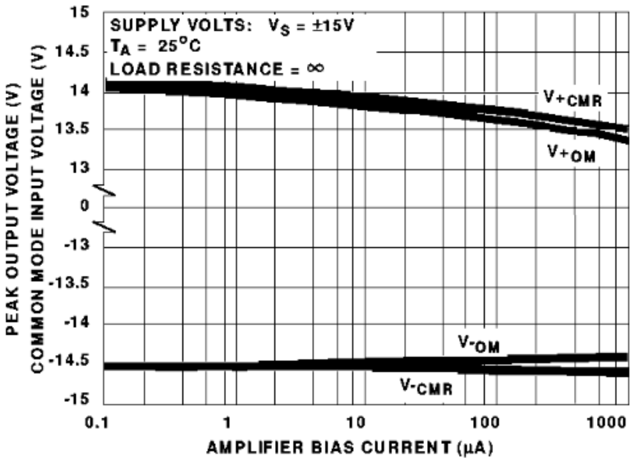


FIGURE 18. PEAK OUTPUT VOLTAGE vs AMPLIFIER BIAS CURRENT

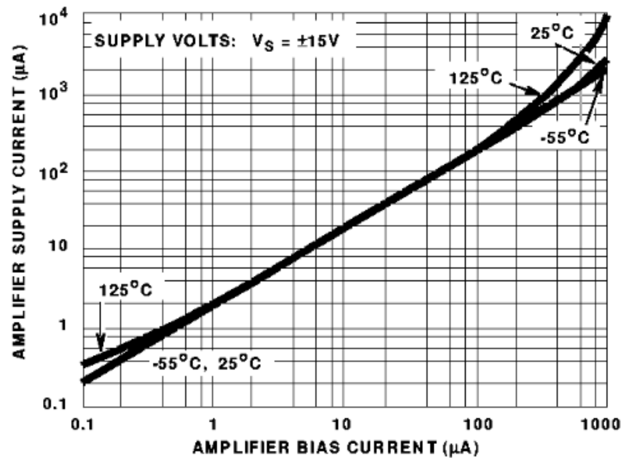


FIGURE 19. AMPLIFIER SUPPLY CURRENT vs AMPLIFIER BIAS CURRENT

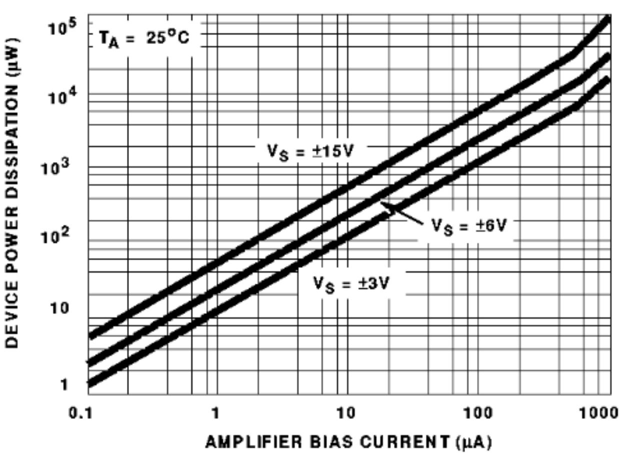


FIGURE 20. TOTAL POWER DISSIPATION vs AMPLIFIER BIAS CURRENT

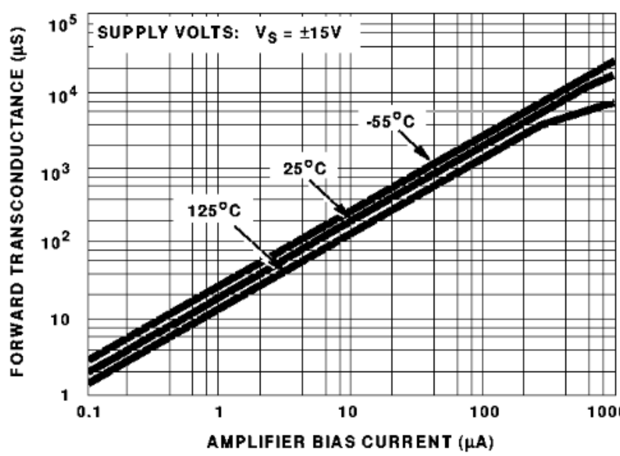


FIGURE 21. TRANSCONDUCTANCE vs AMPLIFIER BIAS CURRENT

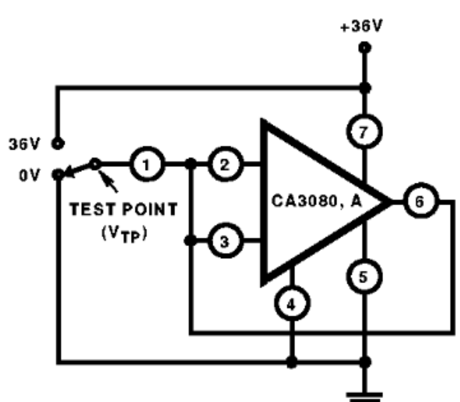


FIGURE 22. LEAKAGE CURRENT TEST CIRCUIT

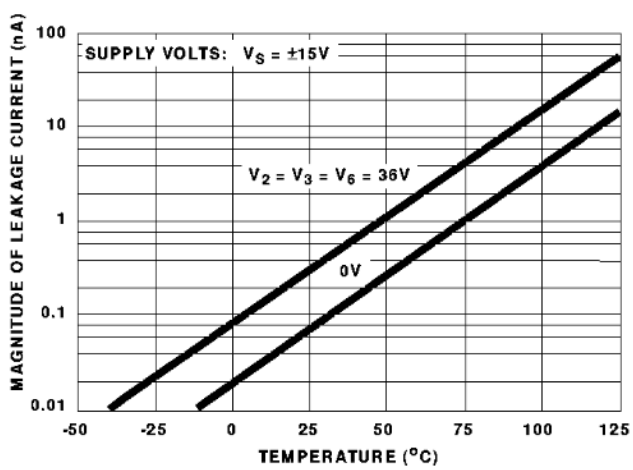


FIGURE 23. LEAKAGE CURRENT vs TEMPERATURE

Typical Performance Curves (Continued)

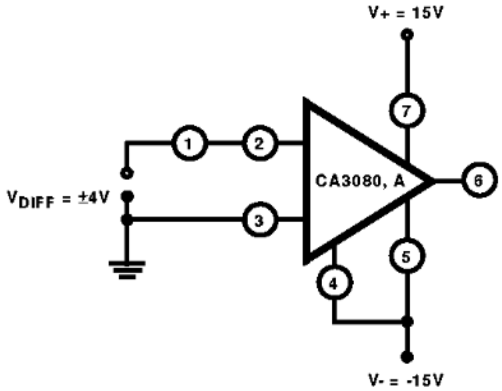


FIGURE 24. DIFFERENTIAL INPUT CURRENT TEST CIRCUIT

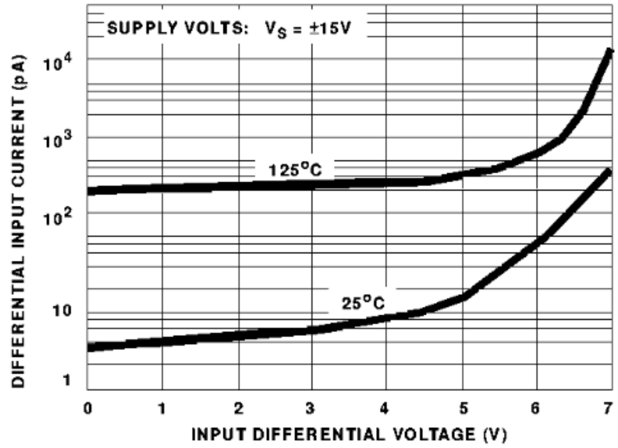


FIGURE 25. INPUT CURRENT vs INPUT DIFFERENTIAL VOLTAGE

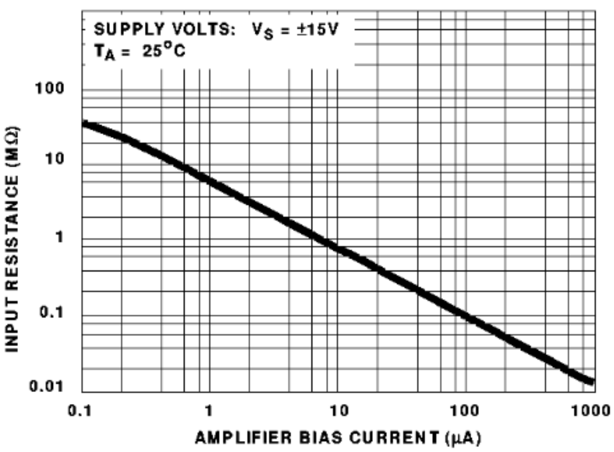


FIGURE 26. INPUT RESISTANCE vs AMPLIFIER BIAS CURRENT

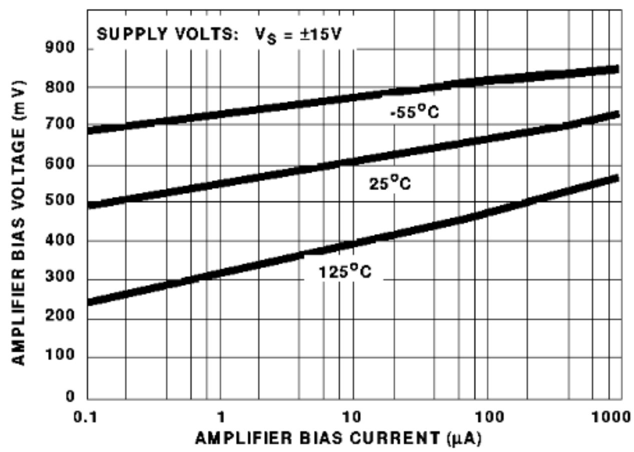


FIGURE 27. AMPLIFIER BIAS VOLTAGE vs AMPLIFIER BIAS CURRENT

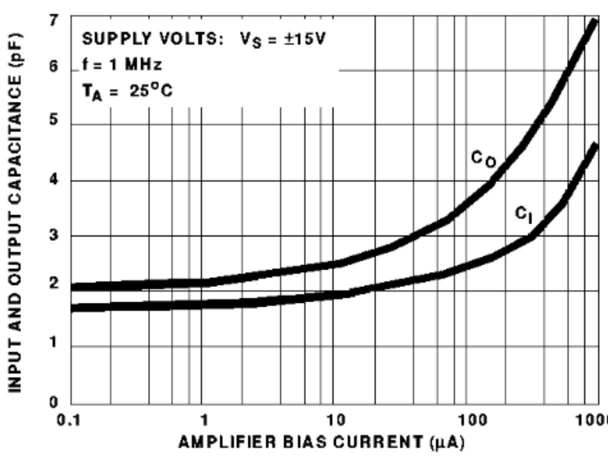


FIGURE 28. INPUT AND OUTPUT CAPACITANCE vs AMPLIFIER BIAS CURRENT

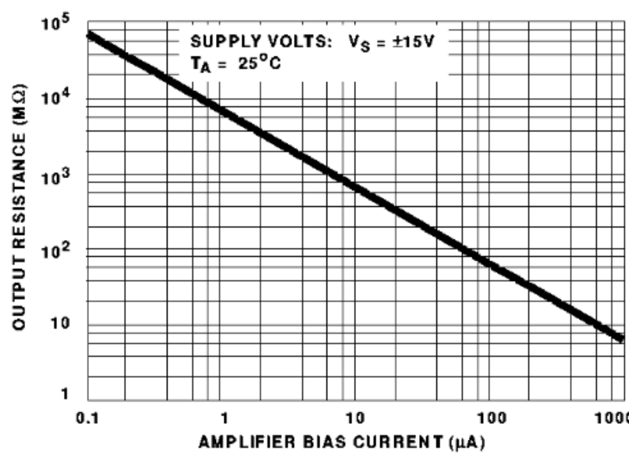


FIGURE 29. OUTPUT RESISTANCE vs AMPLIFIER BIAS CURRENT

Typical Performance Curves (Continued)

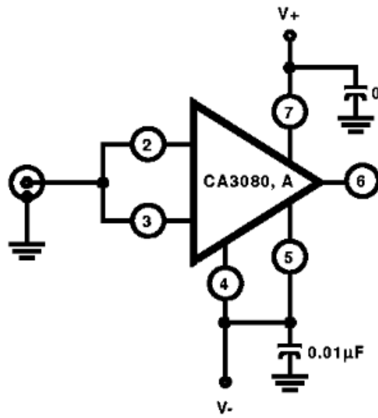


FIGURE 30. INPUT-TO-OUTPUT CAPACITANCE TEST CIRCUIT

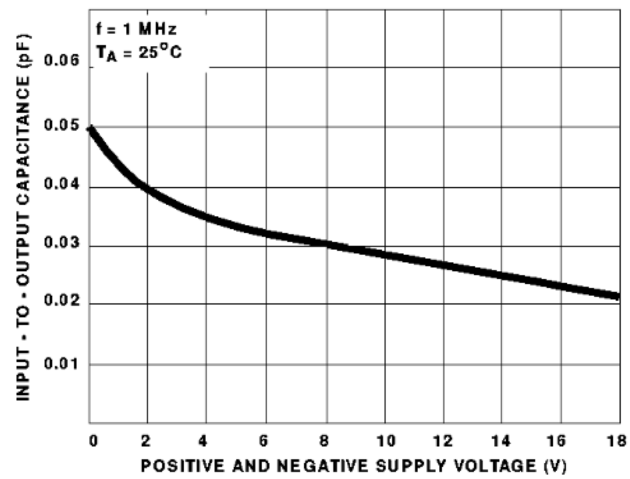


FIGURE 31. INPUT-TO-OUTPUT CAPACITANCE vs SUPPLY VOLTAGE

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