



HARRIS
SEMICONDUCTOR
PRODUCTS DIVISION
A DIVISION OF HARRIS CORPORATION

HA-2600-1

*High Temperature, Wide Band,
High Impedance Operational
Amplifier*

JULY 1979

FEATURES

- CHARACTERIZED TO 250° C
- GUARANTEED FOR OPERATION AT 200° C
- WIDE BANDWIDTH
- HIGH INPUT IMPEDANCE
- LOW INPUT BIAS CURRENT
- LOW INPUT OFFSET CURRENT
- LOW INPUT OFFSET VOLTAGE
- HIGH GAIN

APPLICATIONS

- OIL WELL-LOGGING
- GEOTHERMAL WELL-LOGGING
- INDUSTRIAL PROCESS CONTROL
- ENGINE TESTING AND CONTROL

DESCRIPTION

The HA-2600 is an internally compensated bipolar operational amplifier that features very high input impedance (500 M Ω) coupled with wideband ac performance. The high resistance of the input stage is complemented by low offset voltage (6 mV) and low bias and offset currents (30 nA) at 200° to facilitate accurate signal processing. High-gain bandwidth product, slew rate, and open loop gain allows the 2600 to perform high-gain amplification of fast, wideband signals.

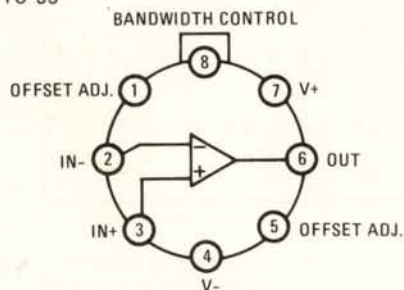
With the HA-2600-1 configuration Harris offers a device that has been characterized up to 250° C and life-tested at 200° C.

A final electrical test at 200° C is also included in the process flow.

This amplifier is ideal for high temperature applications such as oil and geothermal well-logging, industrial process control, engine control, etc.

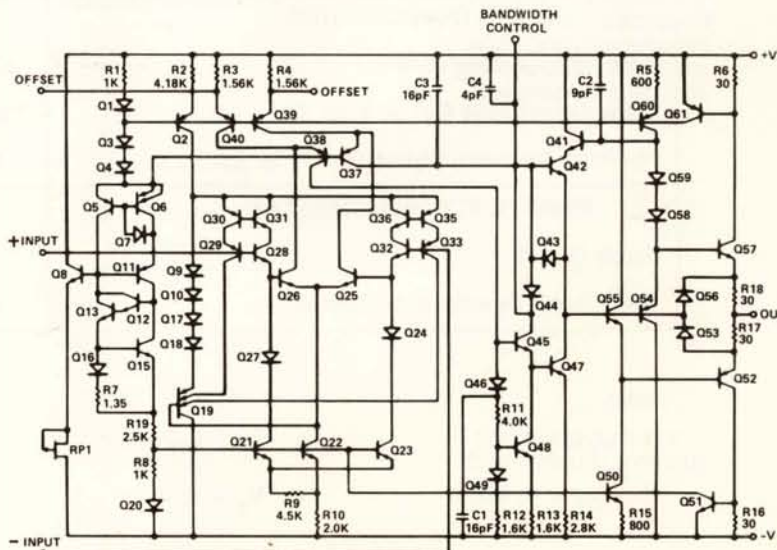
PINOUT

T0-99



CASE CONNECTED TO V-

SCHEMATIC



SPECIFICATIONS

ABSOLUTE MAXIMUM RATINGS

Voltage Between V+ and V-Terminals	45.0 V
Differential Input Voltage	± 12.0 V
Peak Output Current	Full Short Circuit Protection
Internal Power Dissipation	300 mW
Operating Temperature Range	0° C ≤ T _a ≤ +250° C
Storage Temperature Range	-65° C ≤ T _a ≤ +150° C

ELECTRICAL CHARACTERISTICS

$$V_+ = +15 \text{ VDC}, V_- = -15 \text{ VDC}$$

HA-2600-1 Specifications at T = +200° C unless otherwise noted				
PARAMETER	MIN	TYP	MAX	UNITS
INPUT CHARACTERISTICS				
Offset Voltage		2	6	mV
Offset Voltage Average Drift		5		μV/° C
Bias Current		10	30	nA
Offset Current		5	30	nA
Input Resistance (T = +25° C)	100	500		mΩ
Common Mode Range	± 11.0			V
TRANSFER CHARACTERISTICS				
Large Signal Voltage Gain (Notes 1, 4)	50K			V/V
Common Mode Rejection Ratio (Note 2)	80	100		dB
Unity Gain Bandwidth (Note 3) (T = +25° C)		12		MHz
OUTPUT CHARACTERISTICS				
Output Voltage Swing (Note 1)	± 10.0	± 12.0		V
Output Current (Note 4) (T = +25° C)	± 15	± 22		mA
Full Power Bandwidth (Note 4) (T = +25° C)	50	75		KHz
POWER SUPPLY CHARACTERISTICS				
Supply Current		3.0	3.7	mA
Power Supply Rejection Ratio (Note 5)	80	90		dB

Notes:

- R₁ = 2K
- V_{cm} = ± 10.0 V
- V_o < 90mV
- V_o = ± 10 V
- V_s = ± 9.0 V to ± 15 V

PERFORMANCE CURVES

$V_+ = 15V$ DC, $V_- = -15V$ DC, $T_A = +200^\circ$ C UNLESS OTHERWISE STATED

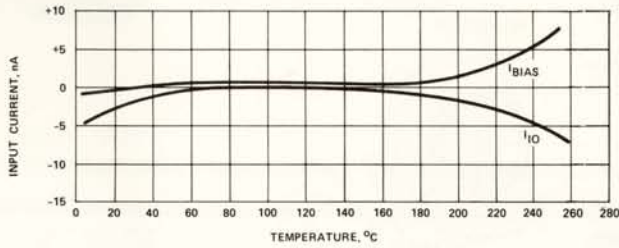


FIGURE 1. BIAS AND OFFSET CURRENT VERSUS TEMPERATURE

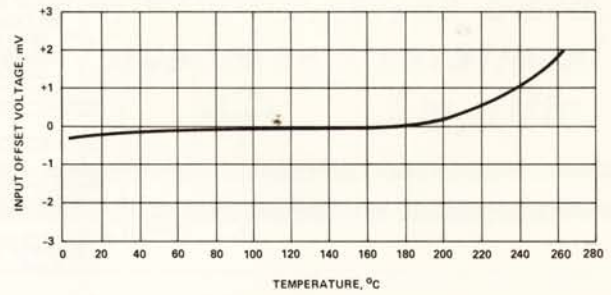


FIGURE 2. INPUT OFFSET VOLTAGE VERSUS TEMPERATURE

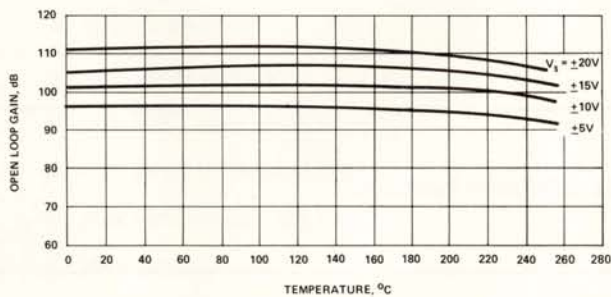


FIGURE 3. OPEN LOOP GAIN VERSUS TEMPERATURE

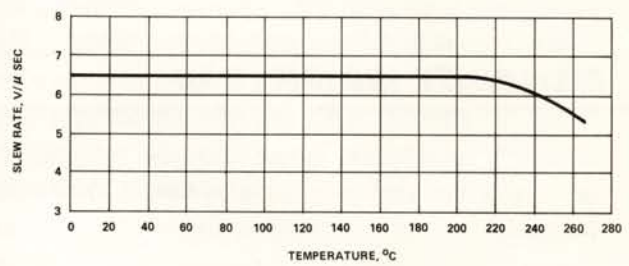


FIGURE 4. SLEW RATE VERSUS TEMPERATURE

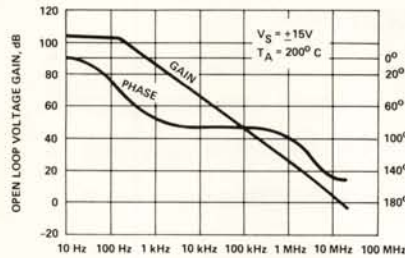


FIGURE 5. OPEN LOOP FREQUENCY AND PHASE RESPONSE

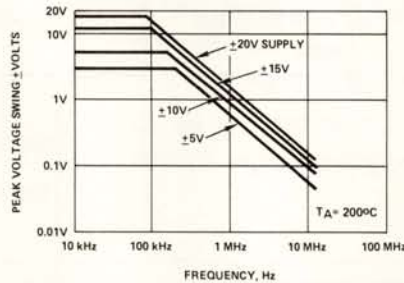
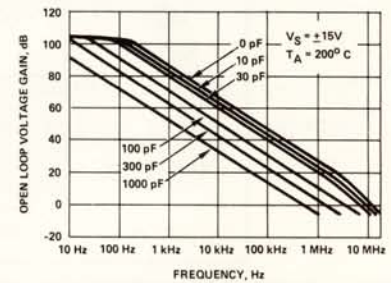


FIGURE 6. OUTPUT VOLTAGE SWING VERSUS FREQUENCY



NOTE: EXTERNAL COMPENSATION COMPONENTS ARE NOT REQUIRED FOR STABILITY, BUT MAY BE ADDED TO REDUCE BANDWIDTH IF DESIRED. IF EXTERNAL COMPENSATION IS USED, ALSO CONNECT 100-μF CAPACITOR FROM OUTPUT TO GROUND.

FIGURE 7. OPEN LOOP FREQUENCY RESPONSE FOR VARIOUS VALUES OF CAPACITORS FROM BANDWIDTH CONTROL PIN TO GROUND

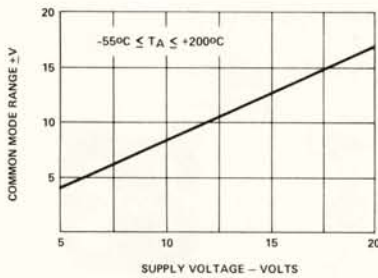
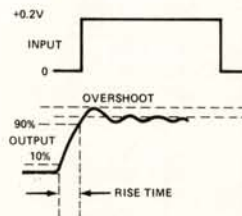
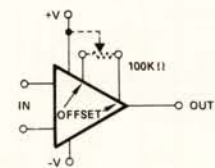


FIGURE 8. COMMON MODE VOLTAGE RANGE AS A FUNCTION OF SUPPLY VOLTAGE



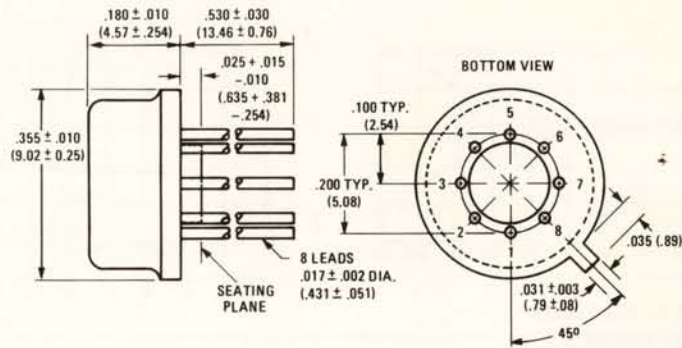
NOTE: MEASURED ON BOTH POSITIVE AND NEGATIVE TRANSITIONS.

TRANSIENT RESPONSE



SUGGESTED OFFSET ZERO ADJUST HOOKUP

PACKAGE



1. All dimensions in inches; millimeters are shown in parentheses.
2. All dimensions $\pm .010$ (± 0.25 mm) unless otherwise shown.

RELIABILITY INFORMATION

Life test data for HA2600-1 is available in Reliability Bulletin 96.

ORDERING INFORMATION

MODEL NUMBER	OPERATING TEMPERATURE RANGE	PRODUCT DESCRIPTION
HA2-2600-1	0°C to $+220^\circ \text{C}$	Characterized and life tested for high temperature operation

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