élantec
HIGH PERFORMANCE ANALOG INTEGRATED CIRCUITS

EHA2600 Series

Wideband, High Impedance Operational Amplifier

T-79-07-10

Features

- High slew rates
- High input impedance—500 MΩ
- Low input bias currents—1 nA
- Low input offset current—1 nA
- High gain—> 100 dB
- Output short circuit protected
- Output clamp
- Low input offset voltage—500 μV

Applications

- Video amplifiers
- Precision comparators
- Pulse amplifiers
- DAC buffers
- High-speed sample and holds

General Description

Elantec's EHA2600 Series of high performance op amps is designed to offer designers high-speed amplifiers without sacrificing DC characteristics. These products are fabricated using Elantec's Complementary Bipolar processes.

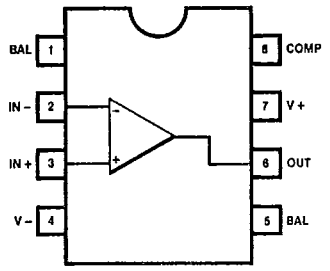
Two different versions are offered. The EHA260X series which is internally compensated and unity gain stable, and the EHA262X series that is optimized for slew rate and bandwidth.

These devices are used in a wide variety of applications including video signal conditioning, instrumentation, and data acquisition systems. For any application that requires high-speed AC and good DC performance to accurately process signals, the EHA2600 series provides excellent performance with over a 100 dB of gain, 1 nA of bias current and gain bandwidths to 100 MHz.

Elantec facilities comply with MIL-I-45208A and other applicable quality specifications. For information on Elantec's military processing, request our brochure: *Elantec's Military Processing—Monolithic Products.*

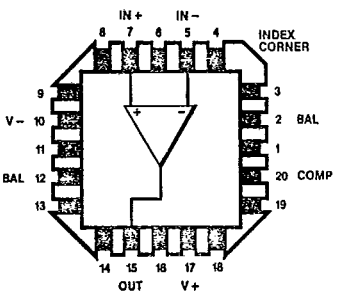
Connection Diagrams

EHA3-, EHA7-



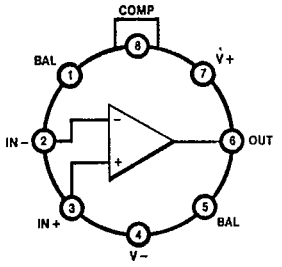
2600-1

EHA4-



2600-2

EHA2-



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Top Views

Note: Non-designated pins are no connects and are not electrically connected internally.

EHA2600 Series

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Selection Guide

Part Number	Temp	V_{OS} (Max) mV	I_{BIAS} (Max) nA	I_{OS} (Max) nA	G_{BW} (Typ) MHz	PBW (Min) kHz	S_R (Min) V/μs	t_{SET} (Typ) μs	PSRR, CMRR (Min) dB	R_{IN} (Min) MΩ	Minimum Stable Gain
EHA2600	M	4	10	10	12	50	4	1.5	80	100	1
EHA2602	M	5	25	25	12	50	4	1.5	74	40	1
EHA2605	C	5	25	25	12	50	4	1.5	74	40	1
EHA2620	M	4	15	15	100	400	25	—	80	65	5
EHA2622	M	5	25	25	100	320	20	—	74	40	5
EHA2625	C	5	25	25	100	320	20	—	74	40	5

Ordering Information

Dice (Note 1) (EHA0-)	14-Pin DIP Ceramic (EHA1-)	TO-99 Metal Can (EHA2-)	8-Pin DIP Plastic (EHA3-)	LCC 20-Pin (EHA4-)	8-Pin DIP CerDIP (EHA7-)
EHA0-2600-6		EHA2-2600/883B EHA2-2600-2 EHA2-2600-1 (Note 3)			EHA7-2600/883B EHA7-2600-2
EHA0-2602-6		EHA2-2602/883B EHA2-2602-2			EHA7-2602/883B EHA7-2602-2
EHA0-2605-6		EHA2-2605-5	EHA3-2605-5		EHA7-2605-5
EHA0-2620-6	(Note 2) (Note 2)	EHA2-2620/883B EHA2-2620-2 EHA2-2620-1 (Note 3)		EHA4-2620/883B	EHA7-2620/883B EHA7-2620-2
EHA0-2622-6	(Note 2) (Note 2)	EHA2-2622/883B EHA2-2622-2			EHA7-2622/883B EHA7-2622-2
EHA0-2625-6	(Note 2)	EHA2-2625-5	EHA3-2625-5		EHA7-2625-5

Note 1: Dice are available in waffle packs. Consult factory for more information.
Note 2: Consult factory for special packaging or temperature range requirements.
Note 3: Contact factory for minimum quantity and availability.

PREFIX		
EHA2–	TO-99 Metal Can	MDP0004
EHA3–	8-Pin Plastic DIP	MDP0031
EHA4–	Leadless Chip Carrier (LCC)	MDP0007
EHA7–	8-Pin CerDIP	MDP0010
EHA0–	Dice	

SUFFIX	
–1	0°C to +200°C
–2	–55°C to +125°C
–3	
–4	–25°C to +85°C
–5	0°C to +75°C
–6	100% 25°C Probe (Dice Only)
–7	
/883B	See Elantec's "Military Processing—Monolithic Products".
–9	

EHA2600/2602/2605

T-79-07-10

Wideband, High Impedance Operational Amplifier

Absolute Maximum Ratings

V_S	Supply Voltage	±22.5V	T_A	Operating Temperature Range	
V_{IN}	Differential Input Voltage	±12V		EHA2600/02	−55°C to +125°C
P_D	Maximum Power Dissipation	See Curves		EHA2605	0°C to +75°C
I_{OP}	Peak Output Current	Short Circuit Protected	T_{ST}	Storage Temperature	−65°C to +150°C
				Lead Temperature (Soldering, 5 seconds)	300°C

Important Note:
All parameters having Min/Max specifications are guaranteed. The Test Level column indicates the specific device testing actually performed during production and Quality inspection. Elantec performs most electrical tests using modern high-speed automatic test equipment, specifically the LTX77 Series system. Unless otherwise noted, all tests are pulsed tests, therefore $T_J = T_C = T_A$.

Test Level	Test Procedure
I	100% production tested and QA sample tested per QA test plan QCX0002.
II	100% production tested at T_A = 25°C and QA sample tested at T_A = 25°C, T_{MAX} and T_{MIN} per QA test plan QCX0002.
III	QA sample tested per QA test plan QCX0002.
IV	Parameter is guaranteed (but not tested) by Design and Characterization Data.
V	Parameter is typical value at T_A = 25°C for information purposes only.

DC Electrical Characteristics

V_S = ±15V, R_S = 50Ω, R_L = 100 kΩ, V_{CM} = 0V, V_{OUT} = 0V, $C_L \le 10$ pF, $T_{MIN} \le T_A \le T_{MAX}$, unless otherwise specified

Parameter	Description	Test Conditions	EHA2600				EHA2602				EHA2605				Units
			Min	Typ	Max	Test Level	Min	Typ	Max	Test Level	Min	Typ	Max	Test Level	
V_{OS}	Offset Voltage	T_A = 25°C		0.5	4	I		3	5	I		3	5	I	mV
				2	6	I			7	I			7	III	mV
$\Delta V_{OS}/\Delta T$	Offset Voltage Drift			5		V		5		V		5		V	µV/°C
I_B	Bias Current (Note 1)	T_A = 25°C		1	10	I		15	25	I		15	25	I	nA
				10	50	I			60	I			40	III	nA
I_{OS}	Offset Current	T_A = 25°C		1	10	I		5	25	I		5	25	I	nA
				5	50	I			60	I			40	III	nA
R_{IN}	Input Resistance	T_A = 25°C	100	500		IV	40	300		IV	40	300		IV	MΩ
V_{CMR}	Common-Mode Range		±11			IV	±11			IV	±11			IV	V
CMRR	Common-Mode Rejection Ratio (Note 2)	ΔV_{CM} = ±10V	80	100		I	74	100		I	74	100		II	dB
PSRR	Power Supply Rejection Ratio (Note 3)	ΔV_S = ±5V	80	90		I	74	90		I	74	90		II	dB
A_{VOL}	Large Signal Voltage Gain (Note 4)	R_L = 2 kΩ, V_O = ±10V, T_A = 25°C	100	150		I	80	150		I	80	150		I	kV/V
		R_L = 2 kΩ, V_O = ±10V	70			I	60			I	70			III	kV/V
V_{OUT}	Output Voltage Swing	R_L = 2 kΩ	±10	±12		I	±10	±12		I	±10	±12		II	V

EHA2600/2602/2605

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DC Electrical Characteristics

$V_S = \pm 15V$, $R_S = 50\Omega$, $R_L = 100\ k\Omega$, $V_{CM} = 0V$, $V_{OUT} = 0V$, $C_L \leq 10\ pF$, $T_{MIN} \leq T_A \leq T_{MAX}$, unless otherwise specified — Contd.

Parameter	Description	Test Conditions	EHA2600				EHA2602				EHA2605				Units
			Min	Typ	Max	Test Level	Min	Typ	Max	Test Level	Min	Typ	Max	Test Level	
I_{OUT}	Output Current	$V_{OUT} = \pm 10V$, $T_A = 25°C$	±15	±22		I	±10	±18		I	±10	±18		I	mA
		$V_{OUT} = \pm 10V$	±7.5			I	±7.5			I	±7.5			III	mA
I_{CC}	Supply Current (Note 5)	$T_A = 25°C$		3	3.7	I		3	4	I		3	4	I	mA

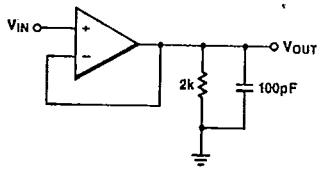
AC Electrical Characteristics

$V_S = \pm 15V$, $R_L = 2\ k\Omega$, $C_L = 100\ pF$, $V_{OUT} = \pm 200\ mV$, $T_{MIN} \leq T_A \leq T_{MAX}$, unless otherwise specified (See AC test circuit)

Parameter	Description	Test Conditions	EHA2600				EHA2602				EHA2605				Units
			Min	Typ	Max	Test Level	Min	Typ	Max	Test Level	Min	Typ	Max	Test Level	
t_r, t_f	Rise and Fall Times	$T_A = 25°C$		30	60	I		30	60	I		30	60	I	ns
					70	I			70	I			70	III	ns
SR	Slew Rate	$V_{OUT} = \pm 5V$, $T_A = 25°C$	±4	±7		I	±4	±7		I	±4	±7		I	V/μs
BW	Unity Gain Bandwidth (Note 6)	$V_{OUT} < 90\ mV$, $T_A = 25°C$		12		V		12		V		12		V	MHz
FPBW	Full Power Bandwidth (Note 6)	$V_{OUT} = \pm 10V$, $T_A = 25°C$	50	75		IV	50	75		IV	50	75		IV	kHz
O.S.	Overshoot	$T_A = 25°C$		25	40	I		25	40	I		25	40	I	%
					50	I			50	I			50	III	%
t_s	Settling Time to 0.1%	$V_{OUT} = \pm 5V$, $T_A = 25°C$		1.5		V		1.5		V		1.5		V	μs

Note 1: Both input currents, I_{B+}, and I_{B-}, are tested individually.
Note 2: For CMRR+, V_{CM} = 0V to +10V and for CMRR−, V_{CM} = 0V to −10V.
Note 3: PSRR+, V_{S+} = +10V to +20V with V_{S-} = −15V. For PSRR−, V_{S-} = −10V to −20V with V_{S+} = +15V.
Note 4: For $A_{VOL}+$, V_{OUT} = 0V to +10V and for $A_{VOL}-$, V_{OUT} = 0V to −10V.
Note 5: Both positive and negative supply currents, $I_{CC}+$, and $I_{CC}-$, are tested.
Note 6: The Full Power Bandwidth is guaranteed by testing slew rate, FPBW = SR/(2π V_P).

EHA260X A.C. Test Circuit



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EHA2600/2602/2605

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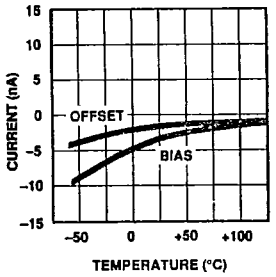
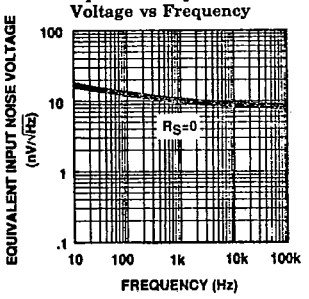
Typical Performance Curves

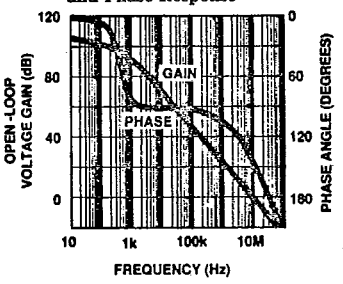
Input Bias Current and Offset Current as a Function of Temperature



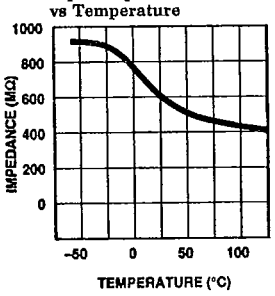
Equivalent Input Noise Voltage vs Frequency



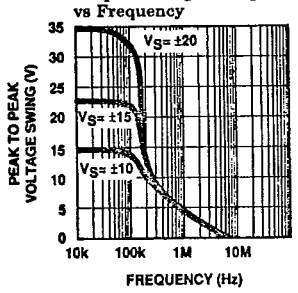
Open-Loop Frequency and Phase Response



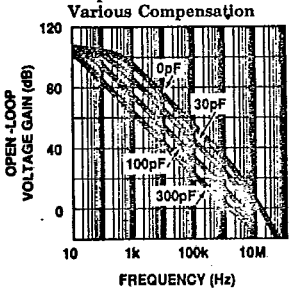
Input Impedance vs Temperature



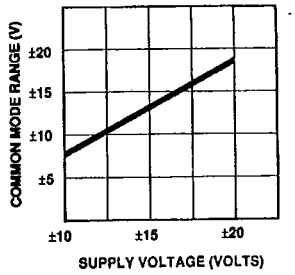
Output Voltage Swing vs Frequency



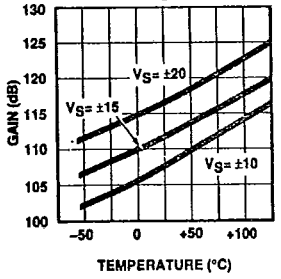
Open-Loop Frequency Response For Various Compensation



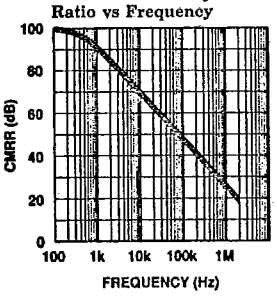
Common Mode Voltage Range as a Function of Supply Voltage



Open-Loop Voltage Gain vs Temperature



Common Mode Rejection Ratio vs Frequency



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EHA2600/2602/2605

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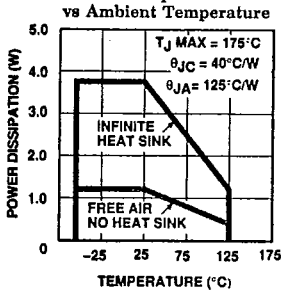
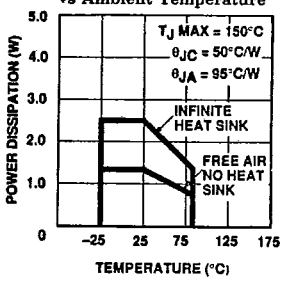
Typical Performance Curves — Contd.

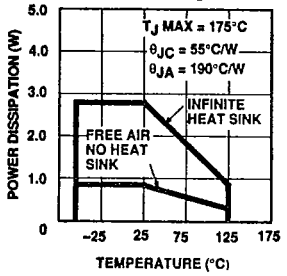
8-Lead CerDIP Maximum Power Dissipation vs Ambient Temperature



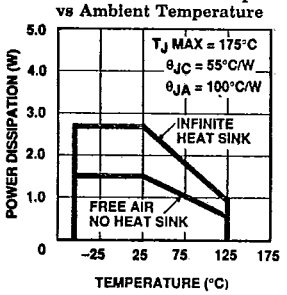
8-Lead Plastic DIP Maximum Power Dissipation vs Ambient Temperature



8-Lead TO-99 Metal Can Maximum Power Dissipation vs Ambient Temperature



20-Pad LCC Maximum Power Dissipation vs Ambient Temperature



2600-6

EHA2620/2622/2625

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Wideband, High Impedance Operational Amplifier

Absolute Maximum Ratings

V_S	Supply Voltage	±22.5V	T_A	Operating Temperature Range	
V_{IN}	Differential Input Voltage	±12.0V		EHA2620/22	−55°C to +125°C
P_D	Maximum Power Dissipation	See Curves		EHA2625	0°C to +75°C
I_{OP}	Peak Output Current	Short Circuit Protected	T_{ST}	Storage Temperature	−65°C to +150°C
				Lead Temperature (Soldering, 5 seconds)	300°C

Important Note:
All parameters having Min/Max specifications are guaranteed. The Test Level column indicates the specific device testing actually performed during production and Quality inspection. Elantec performs most electrical tests using modern high-speed automatic test equipment, specifically the LTX77 Series system. Unless otherwise noted, all tests are pulsed tests, therefore $T_J = T_C = T_A$.

Test Level	Test Procedure
I	100% production tested and QA sample tested per QA test plan QCX0002.
II	100% production tested at T_A = 25°C and QA sample tested at T_A = 25°C, T_{MAX} and T_{MIN} per QA test plan QCX0002.
III	QA sample tested per QA test plan QCX0002.
IV	Parameter is guaranteed (but not tested) by Design and Characterization Data.
V	Parameter is typical value at T_A = 25°C for information purposes only.

DC Electrical Characteristics

V_S = ±15V, R_S = 50Ω, R_L = 100 kΩ, V_{CM} = 0V, V_{OUT} = 0V, $T_{MIN} \le T_A \le T_{MAX}$, unless otherwise specified

Parameter	Description	Test Conditions	EHA2620				EHA2622				EHA2625				Units
			Min	Typ	Max	Test Level	Min	Typ	Max	Test Level	Min	Typ	Max	Test Level	
V_{OS}	Offset Voltage	T_A = 25°C		0.5	4	I		3	5	I		3	5	I	mV
				2	6	I			7	I			7	III	mV
$\Delta V_{OS}/\Delta T$	Offset Voltage Drift			5		V		5		V		5		V	µV/°C
I_B	Bias Current (Note 1)	T_A = 25°C		1	15	I		15	25	I		15	25	I	nA
				10	50	I			60	I			40	III	nA
I_{OS}	Offset Current	T_A = 25°C		1	15	I		5	25	I		5	25	I	nA
				5	50	I			60	I			40	III	nA
R_{IN}	Input Resistance	T_A = 25°C	65	500		IV	40	300		IV	40	300		IV	MΩ
V_{CMR}	Common-Mode Range		±11.0			IV	±11.0			IV	±11.0			IV	V
CMRR	Common-Mode Rejection Ratio (Note 2)	ΔV_{CM} = ±10V	80	100		I	74	100		I	74	100		II	dB
PSRR	Power Supply Rejection Ratio (Note 3)	ΔV_S = ±5V	80	90		I	74	90		I	74	90		II	dB

EHA2620/2622/2625

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DC Electrical Characteristics

$V_S = \pm 15V$, $R_S = 50\Omega$, $R_L = 100\ k\Omega$, $V_{CM} = 0V$, $V_{OUT} = 0V$, $T_{MIN} \le T_A \le T_{MAX}$, unless otherwise specified — Contd.

Parameter	Description	Test Conditions	EHA2620				EHA2622				EHA2625				Units
			Min	Typ	Max	Test Level	Min	Typ	Max	Test Level	Min	Typ	Max	Test Level	
A_{VOL}	Large Signal Voltage Gain (Note 4)	$R_L = 2\ k\Omega$, $V_O = \pm 10V$, $T_A = 25°C$	100	150		I	80	150		I	80	150		I	kV/V
		$R_L = 2\ k\Omega$, $V_O = \pm 10V$	70			I	60			I	70			III	kV/V
V_O	Output Voltage Swing	$R_L = 2\ k\Omega$	±10	±12		I	±10	±12		I	±10	±12		II	V
I_{OUT}	Output Current	$V_{OUT} = \pm 10V$, $T_A = 25°C$	±15	±22		I	±10	±18		I	±10	±18		I	mA
		$V_{OUT} = \pm 10V$	±7.5			I	±7.5			I	±7.5			III	mA
I_{CC}	Supply Current (Note 5)	$T_A = 25°C$		3	3.7	I		3	4	I		3	4	I	mA

AC Electrical Characteristics

$V_S = \pm 15V$, $R_S = 50\Omega$, $R_L = 2\ k\Omega$, $C_L = 50\ pF$, $V_{OUT} = \pm 200\ mV$, $T_{MIN} \le T_A \le T_{MAX}$, unless otherwise specified
(See AC test circuit)

Parameter	Description	Test Conditions	EHA2620				EHA2622				EHA2625				Units
			Min	Typ	Max	Test Level	Min	Typ	Max	Test Level	Min	Typ	Max	Test Level	
t_r, t_f	Rise and Fall Times	$A_V = 5V$, $T_A = 25°C$		17	45	I		17	45	I		30	45	I	ns
		$A_V = 5V$			60	I			70	I			70	III	ns
SR	Slew Rate	$V_{OUT} = \pm 5V$, $A_V = 5V$, $T_A = 25°C$	±25	±35		I	±20	±35		I	±20	±35		I	V/μs
GBW	Gain Bandwidth Product	$V_O \le 90\ mV$, $A_V = 100V$ $T_A = 25°C$		100		V		100		V		100		V	MHz
FPBW	Full Power Bandwidth (Note 6)	$V_{OUT} = \pm 10V$, $T_A = 25°C$	400	600		IV	320	600		IV	320	600		IV	kHz
O.S.	Overshoot	$T_A = 25°C$			60	I			60	I			60	I	%
					70	I			70	I			70	III	%

Note 1: Both input currents, I_{B+}, and I_{B-}, are tested individually.
Note 2: For CMRR+, V_{CM} = 0V to +10V and for CMRR−, V_{CM} = 0V to −10V.
Note 3: PSRR+, V_{S+} = +10V to +20V with V_{S-} = −15V. For PSRR−, V_{S-} = −10V to −20V with V_{S+} = +15V.
Note 4: For $A_{VOL}+$, V_{OUT} = 0V to +10V and for $A_{VOL}-$, V_{OUT} = 0V to −10V.
Note 5: Both positive and negative supply currents, $I_{CC}+$, and $I_{CC}-$ are tested.
Note 6: The Full Power Bandwidth is guaranteed by testing slew rate, FPBW = $SR/(2\pi V_P)$.

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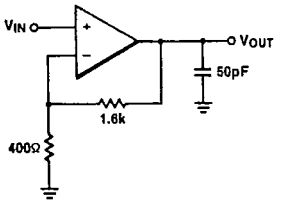
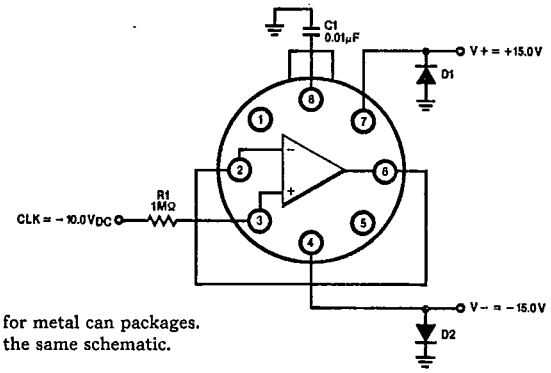
AC Electrical Characteristics — Contd.

EH262X AC Test Circuit



2600-7

Burn-In Circuit



Pin numbers are for metal can packages.
All packages use the same schematic.

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Top View

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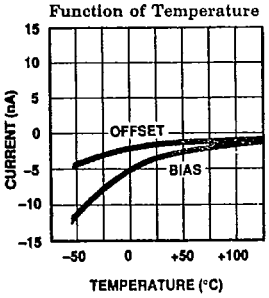
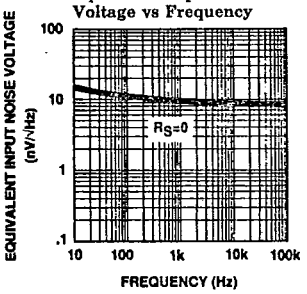
Typical Performance Curves

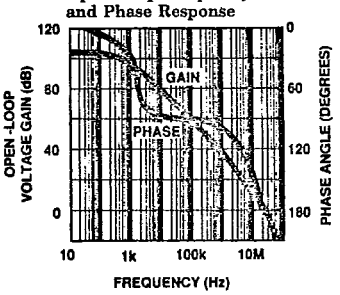
Input Bias Current and Offset Current as a Function of Temperature



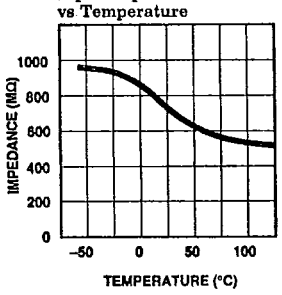
Equivalent Input Noise Voltage vs Frequency



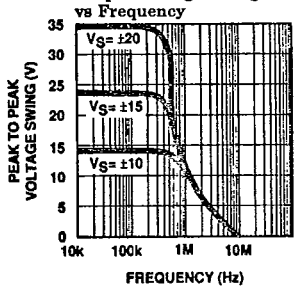
Open-Loop Frequency and Phase Response



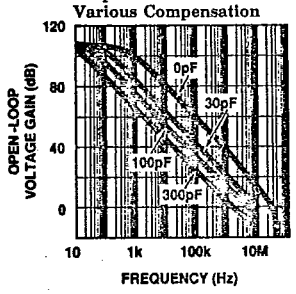
Input Impedance vs Temperature



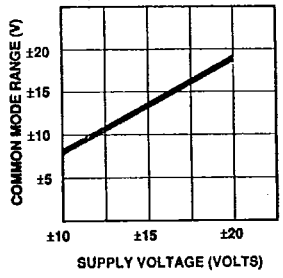
Output Voltage Swing vs Frequency



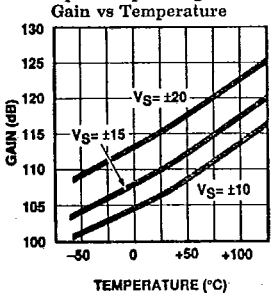
Open-Loop Frequency Response For Various Compensation



Common Mode Voltage Range as a Function of Supply Voltage



Open-Loop Voltage Gain vs Temperature



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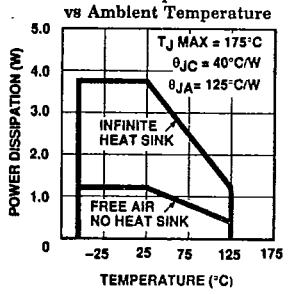
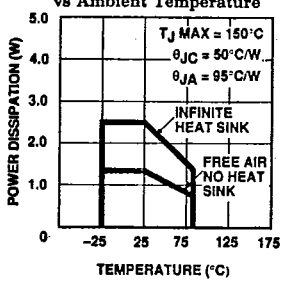
Typical Performance Curves — Contd.

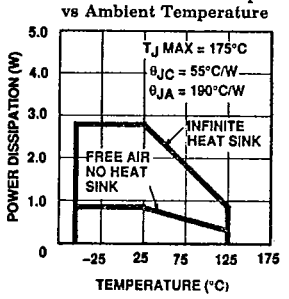
8-Lead CerDIP Maximum Power Dissipation vs Ambient Temperature



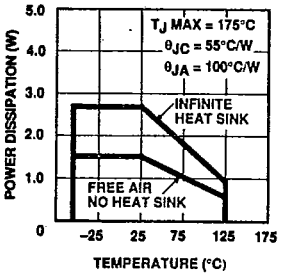
8-Lead Plastic DIP Maximum Power Dissipation vs Ambient Temperature



8-Lead TO-99 Metal Can Maximum Power Dissipation vs Ambient Temperature



20-Pad LCC Maximum Power Dissipation vs Ambient Temperature



2600-10

EHA2600 Series

Wideband, High Impedance Operational Amplifier

EHA2600 Macromodel

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```
* Connections:      +input
*                   |    -input
*                   |    |    +Vsupply
*                   |    |    |    -Vsupply
*                   |    |    |    |    output
*                   |    |    |    |    |    comp
*                   |    |    |    |    |    |
.subckt M2600       3    2    7    4    6    8
* Input Stage
ie 37 4 26uA
r6 36 37 1K
r7 38 37 1K
rc1 7 30 3K
rc2 7 39 3K
q1 30 3 36 qn
q2 39 2 38 qna
ediff 33 0 39 30 1.00
rdiff 33 0 1Meg
* Compensation Section
ga 0 8 33 0 1m
rh 8 0 150Meg
ch 8 0 1.5pF
rc 8 40 5K
cc 40 0 1pF
* Poles
ep 41 0 40 0 1
rpa 41 42 200
cpa 42 0 8pF
rpb 42 43 1K
cpb 43 0 8pF
* Output Stage
ios1 7 50 1.0mA
ios2 51 4 1.0mA
q3 4 43 50 qp
q4 7 43 51 qn
q5 7 50 52 qn
q6 4 51 53 qp
ros1 52 6 25
ros2 6 53 25
* Power Supply Current
ips 7 4 0.5mA
* Models
.model qn npn(is=800.0e-18 bf=5e3 tf=0.2nS)
.model qna npn(is=864e-18 bf=6e3 tf=0.2nS)
.model qp pnp(is=800e-18 bf=5e3 tf=0.2nS)
.ends
```

EHA2600 Series

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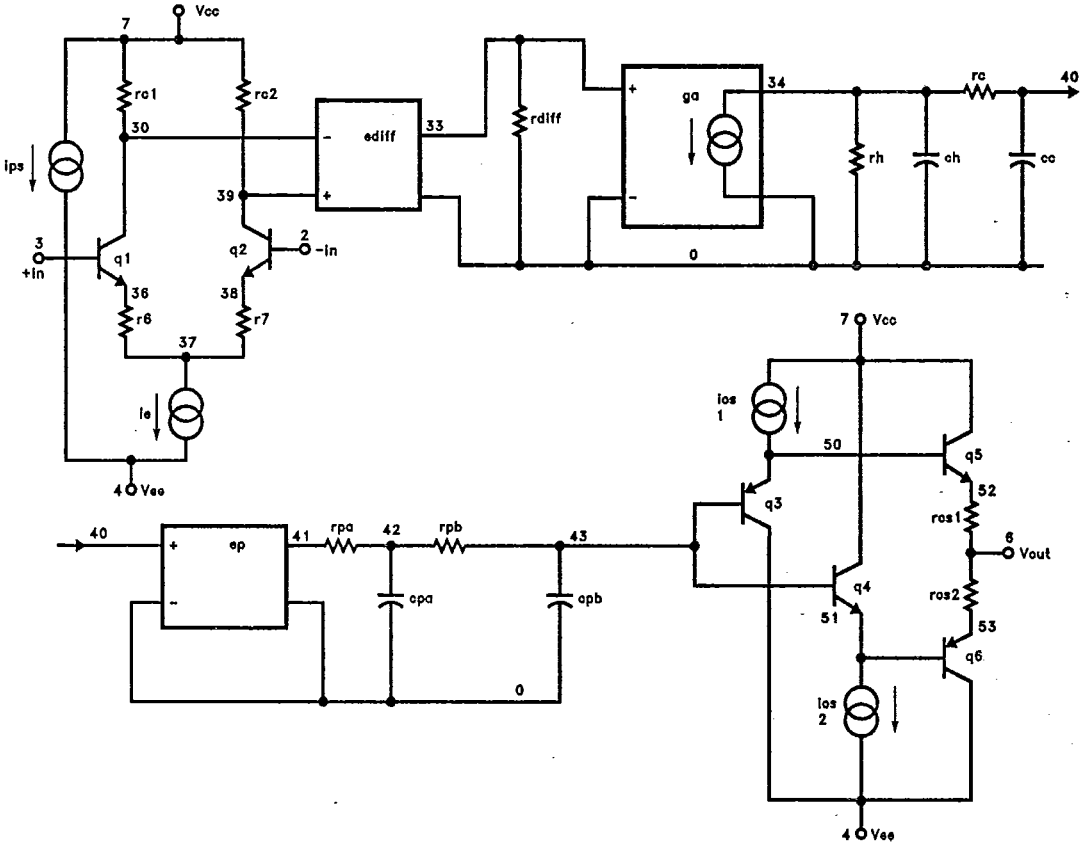
Wideband, High Impedance Operational Amplifier

EHA2600 Macromodel — Contd.



EHA2600 Series

Wideband, High Impedance Operational Amplifier

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EHA2620 Macromodel

```
* Connections:      +input
*                   |    -input
*                   |    |    +Vsupply
*                   |    |    |    -Vsupply
*                   |    |    |    |    output
*                   |    |    |    |    |    comp
*                   |    |    |    |    |    |
.subckt M2620       3    2    7    4    6    8
* Input Stage
ie 37 4 26uA
r6 36 37 1K
r7 38 37 1K
rc1 7 30 3K
rc2 7 39 3K
q1 30 3 36 qn
q2 39 2 38 qna
ediff 33 0 39 30 1.00
rdiff 33 0 1Meg
* Compensation Section
ga 0 8 33 0 1m
rh 8 0 150Meg
ch 8 0 1.5pF
rc 8 40 5K
cc 40 0 1pF
* Poles
ep 41 0 40 0 1
rpa 41 42 200
cpa 42 0 8pF
rpb 42 43 1K
cpb 43 0 8pF
* Output Stage
ios1 7 50 1.0mA
ios2 51 4 1.0mA
q3 4 43 50 qp
q4 7 43 51 qn
q5 7 50 52 qn
q6 4 51 53 qp
ros1 52 6 25
ros2 6 53 25
* Power Supply Current
ips 7 4 0.5mA
* Models
.model qn npn(is=800.0e-18 bf=5e3 tf=0.2nS)
.model qna npn(is=864e-18 bf=6e3 tf=0.2nS)
.model qp pnp(is=800e-18 bf=5e3 tf=0.2nS)
.ends
```

EHA2600 Series

Wideband, High Impedance Operational Amplifier

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EHA2620 Macromodel — Contd.