OBSOLETE PRODUCT
POSSIBLE SUBSTITUTE PRODUCT
HA-2525

12MHz, High Input Impedance, Operational Amplifier

HA-2505 is an operational amplifier whose design is optimized to deliver excellent slew rate, bandwidth, and settling time specifications. The outstanding dynamic features of this internally compensated device are complemented with low offset voltage and offset current.

This dielectrically isolated amplifier is ideally suited for applications such as data acquisition, RF, video, and pulse conditioning circuits. Slew rates of ±30V/μs and 330ns (0.1%) settling time make this device an excellent component in fast, accurate data acquisition and pulse amplification designs. 12MHz small signal bandwidth and 500kHz power bandwidth make this device well suited to RF and video applications. With 2mV typical offset voltage plus offset trim capability and 10nA offset current, HA-2505 is particularly useful in signal conditioning designs.

The gain and offset voltage figures of the HA-2505 are optimized by internal component value changes while the similar design of the HA-2515 is maximized for slew rate.

MIL-STD-883 product and data sheets are available upon request.

Part Number Information

PART NUMBER	TEMP RANGE (^oC)	PACKAGE	PKG. NO.
HA3-2505-5	0 to 75	8 Ld PDIP	E8.3

Features

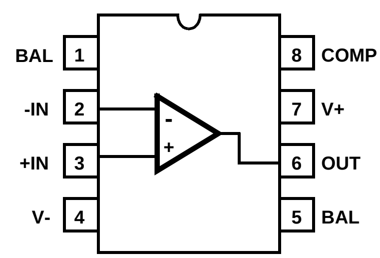
- Slew Rate 30V/μs
- Fast Settling 330ns
- Full Power Bandwidth 500kHz
- Gain Bandwidth 12MHz
- High Input Impedance 50MΩ
- Low Offset Current 10nA
- Internally Compensated For Unity Gain Stability

Applications

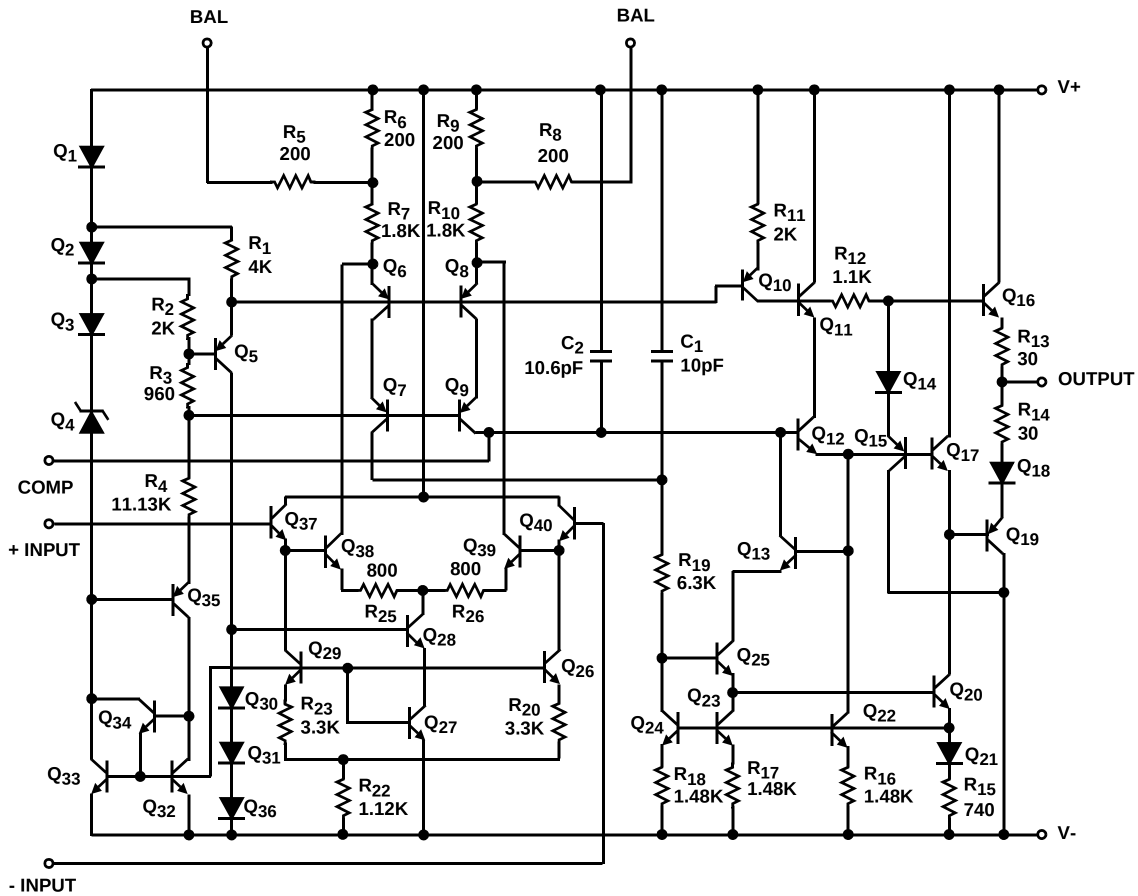
- Data Acquisition Systems
- RF Amplifiers
- Video Amplifiers
- Signal Generators

Pinout

HA-2505 (PDIP)
TOP VIEW



Schematic


BAL
BAL
V+
Q1
R5
200
R6
200
R9
200
R8
200
R7
1.8K
R10
1.8K
R11
2K
Q2
R1
4K
Q6
Q8
Q10
R12
1.1K
Q16
Q3
R2
2K
Q5
Q11
R13
30
C2
10.6pF
C1
10pF
R3
960
Q7
Q9
Q14
OUTPUT
Q4
R14
30
Q12
Q15
Q17
COMP
Q18
R4
11.13K
Q37
Q40
+ INPUT
Q38
Q39
800
800
Q19
R19
6.3K
Q13
Q35
R25
R26
Q28
Q29
Q25
Q26
Q20
Q23
Q30
R23
3.3K
R20
3.3K
Q22
Q34
Q27
Q24
Q31
Q21
Q33
R22
1.12K
R18
1.48K
R17
1.48K
R16
1.48K
R15
740
Q32
Q36
V-
- INPUT

Absolute Maximum Ratings

Supply Voltage Between V+ and V- Terminals 40V
Differential Input Voltage 15V
Peak Output Current 50mA

Operating Conditions

Temperature Range
HA-2505-5 . . . . 0^oC to 75^oC

Thermal Information

Thermal Resistance (Typical, Note 1) θ_{JA} ($^oC/W$)
PDIP Package 96
Maximum Junction Temperature (Plastic Package) . . . . 150^oC
Maximum Storage Temperature Range . . . . -65^oC to 150^oC
Maximum Lead Temperature (Soldering 10s) . . . . 300^oC

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.

NOTE:

1. θ_{JA} is measured with the component mounted on an evaluation PC board in free air.

Electrical Specifications $V_S = \pm15V$

PARAMETER	TEMP (^oC)	HA-2505-5			UNITS
		MIN	TYP	MAX	
INPUT CHARACTERISTICS					
Offset Voltage	25	-	4	8	mV
	Full	-	-	10	mV
Offset Voltage Average Drift	Full	-	20	-	$\mu V/^oC$
Bias Current	25	-	125	250	nA
	Full	-	-	500	nA
Offset Current	25	-	20	50	nA
	Full	-	-	100	nA
Input Resistance (Note 2)	25	20	50	-	MΩ
Common Mode Range	Full	±10	-	-	V
TRANSFER CHARACTERISTICS					
Large Signal Voltage Gain (Notes 3, 6)	25	15	25	-	kV/V
	Full	10	-	-	kV/V
Common Mode Rejection Ratio (Note 4)	Full	74	90	-	dB
Gain Bandwidth Product (Note 5)	25	-	12	-	MHz
OUTPUT CHARACTERISTICS					
Output Voltage Swing (Note 3)	Full	±10	±12	-	V
Output Current (Note 6)	25	±10	±20	-	mA
Full Power Bandwidth (Notes 6, 11)	25	300	500	-	kHz
TRANSIENT RESPONSE					
Rise Time (Notes 3, 7, 8, 9)	25	-	25	50	ns
Overshoot (Notes 3, 7, 8, 9)	25	-	25	50	%
Slew Rate (Notes 3, 7, 9, 12)	25	±20	±30	-	V/μs
Settling Time to 0.1% (Notes 3, 7, 9, 12)	25	-	0.33	-	μs
POWER SUPPLY CHARACTERISTICS					
Supply Current	25	-	4	6	mA
PSRR (Note 10)	Full	74	90	-	dB

NOTES:

2. This parameter value is based on design calculations.
3. $R_L = 2k\Omega$.
4. $V_{CM} = \pm10V$.
5. $A_V > 10$.
6. $V_O = \pm10V$.
7. $C_L = 50pF$.
8. $V_O = \pm200mV$.
9. See Transient Response Test Circuits and Waveforms.
10. $\Delta V = \pm5V$.
11. Full Power Bandwidth guaranteed based on slew rate measurement using: FPBW = Slew Rate/$2\pi V_{PEAK}$.
12. $V_{OUT} = \pm5V$.

Test Circuits and Waveforms

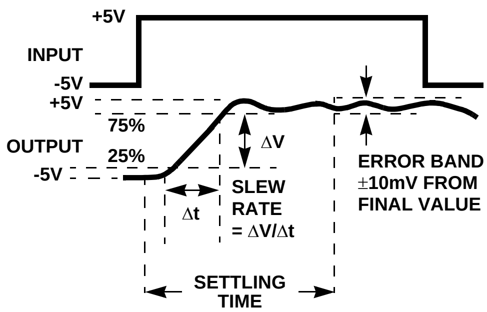
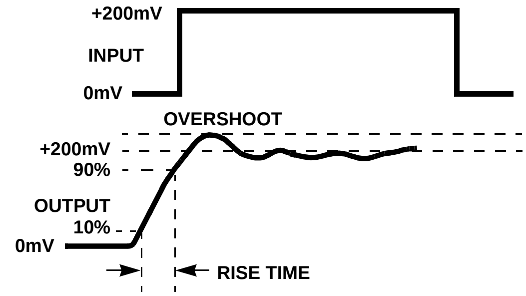


FIGURE 1. SLEW RATE AND SETTLING TIME



NOTE: Measured on both positive and negative transitions from 0V to +200mV and 0V to -200mV at the output.

FIGURE 2. TRANSIENT RESPONSE

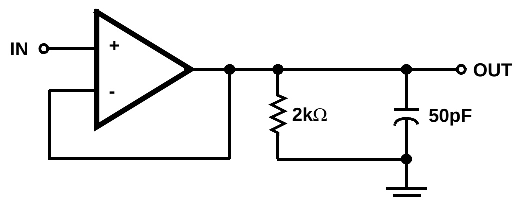
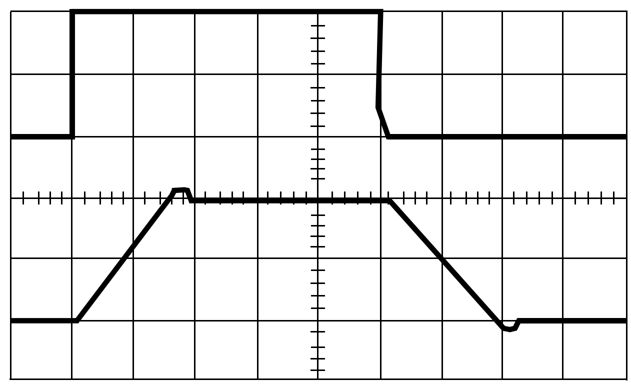
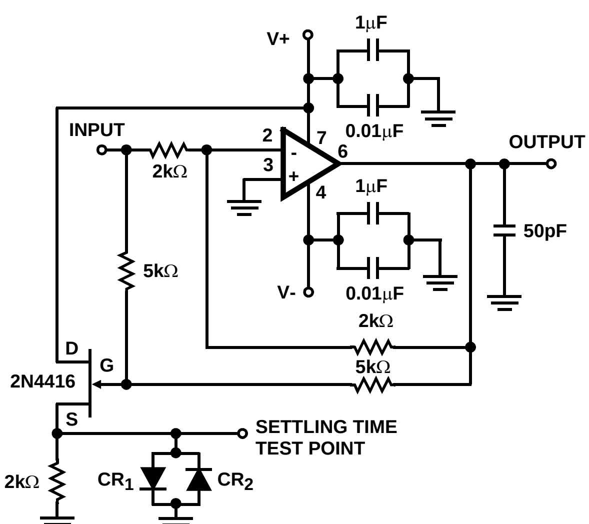


FIGURE 3. SLEW RATE AND TRANSIENT RESPONSE



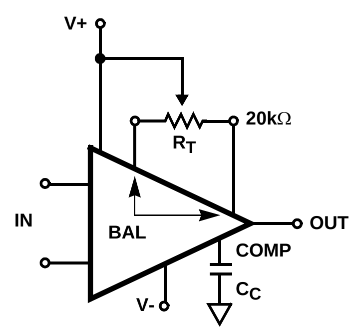
$R_L = 2k\Omega$, $C_L = 50pF$ Vertical = 5V/Div.
Upper Trace: Input Horizontal = 200ns/Div.
Lower Trace: Output $T_A = 25^oC$, $V_S = \pm15V$

FIGURE 4. VOLTAGE FOLLOWER PULSE RESPONSE



13. $A_V = -1$.
14. Feedback and Summing Resistor Ratios should be 0.1% matched.
15. Clipping Diodes CR_1 and CR_2 are optional. HP5082-2810 recommended.

FIGURE 5. SETTLING TIME TEST CIRCUIT



NOTE: Tested offset adjustment range is $|V_{OS} + 1mV|$ minimum referred to output. Typical ranges are ±6mV with $R_T = 20k\Omega$.

FIGURE 6. SUGGESTED V_{OS} ADJUSTMENT AND COMPENSATION HOOK UP

Typical Performance Curves $V_S = \pm15V$, $T_A = 25^oC$, Unless Otherwise Specified

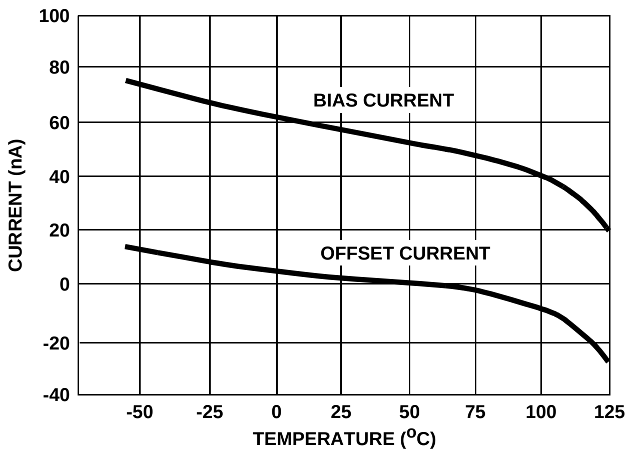


FIGURE 7. INPUT BIAS AND OFFSET CURRENT vs TEMPERATURE

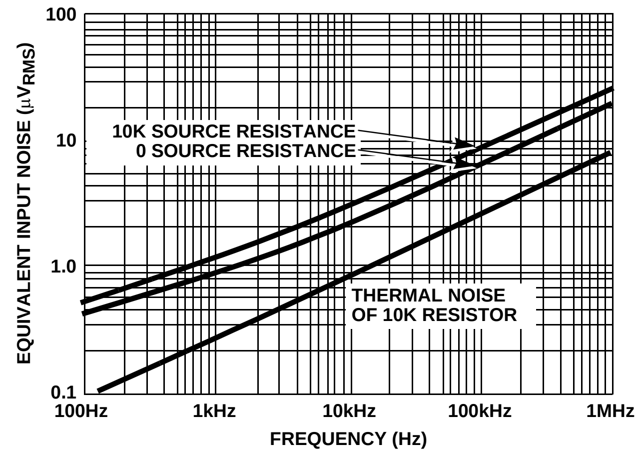


FIGURE 8. EQUIVALENT INPUT NOISE vs BANDWIDTH (WITH 10Hz HIGH PASS FILTER)

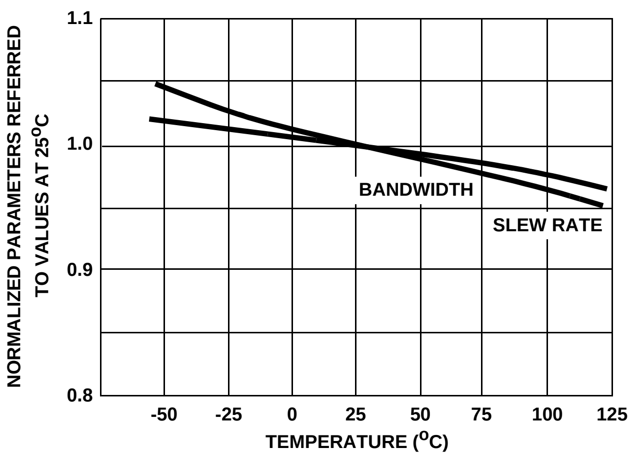


FIGURE 9. NORMALIZED AC PARAMETERS vs TEMPERATURE

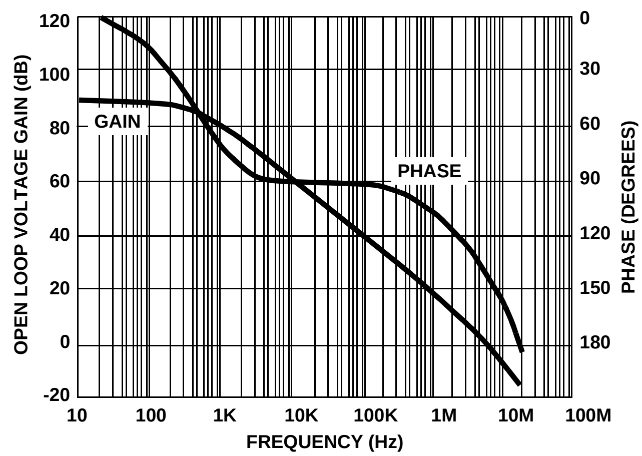


FIGURE 10. OPEN LOOP FREQUENCY AND PHASE RESPONSE

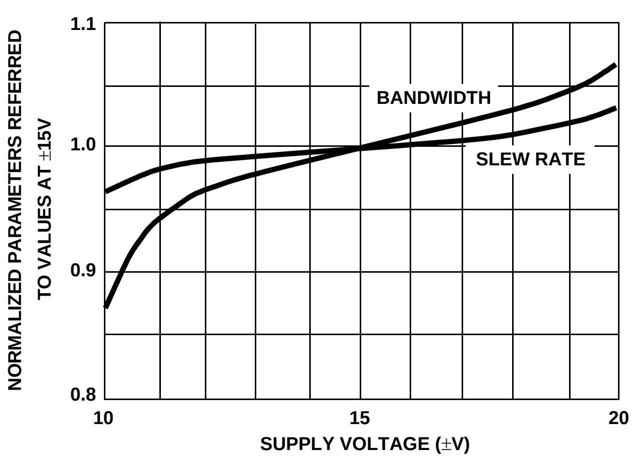
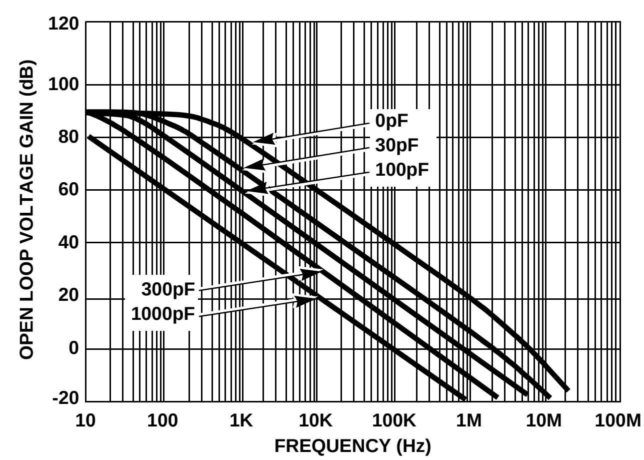


FIGURE 11. NORMALIZED AC PARAMETERS vs SUPPLY VOLTAGE



NOTE: External compensation components are not required for stability, but may be added to reduce bandwidth if desired.

FIGURE 12. OPEN LOOP FREQUENCY RESPONSE FOR VARIOUS VALUES OF CAPACITORS FROM COMPENSATION PIN TO GROUND

Typical Performance Curves $V_S = \pm15V$, $T_A = 25^oC$, Unless Otherwise Specified **(Continued)**

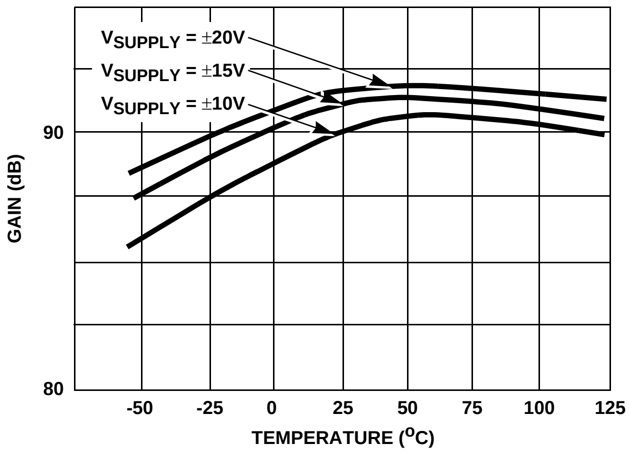


FIGURE 13. OPEN LOOP VOLTAGE GAIN vs TEMPERATURE

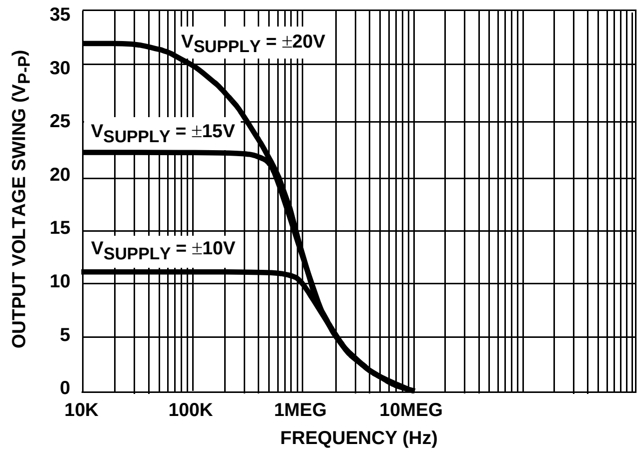


FIGURE 14. OUTPUT VOLTAGE SWING vs FREQUENCY

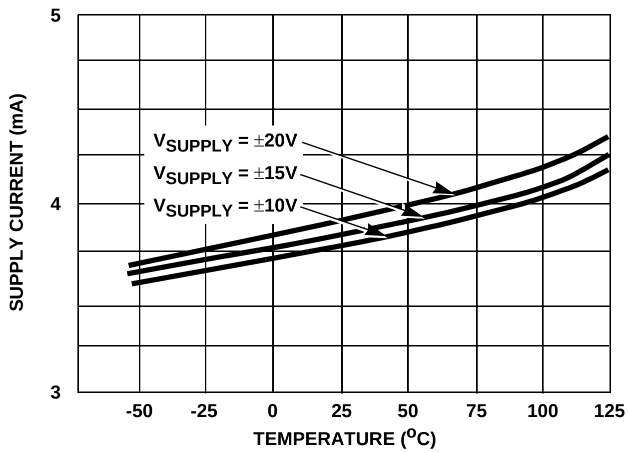


FIGURE 15. POWER SUPPLY CURRENT vs TEMPERATURE

Die Characteristics

DIE DIMENSIONS:

57 mils x 65 mils x 19 mils
1450µm x 1650µm x 483µm

METALLIZATION:

Type: Al, 1% Cu
Thickness: 16kÅ ± 2kÅ

PASSIVATION:

Type: Nitride (Si_3N_4) over Silox (SiO_2, 5% Phos.)
Silox Thickness: 12kÅ ± 2kÅ
Nitride Thickness: 3.5kÅ ± 1.5kÅ

SUBSTRATE POTENTIAL (POWERED UP):

Unbiased

TRANSISTOR COUNT:

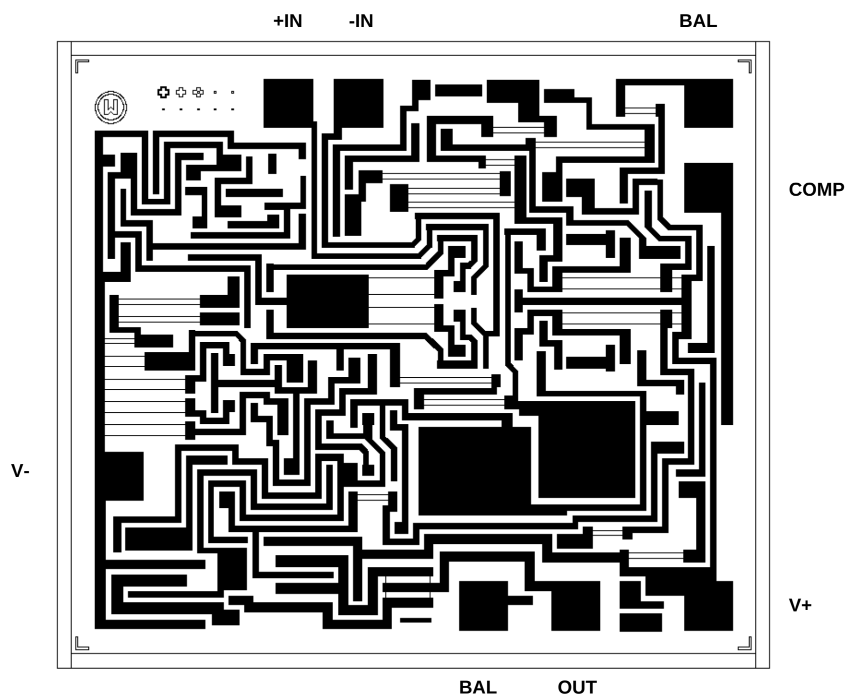
40

PROCESS:

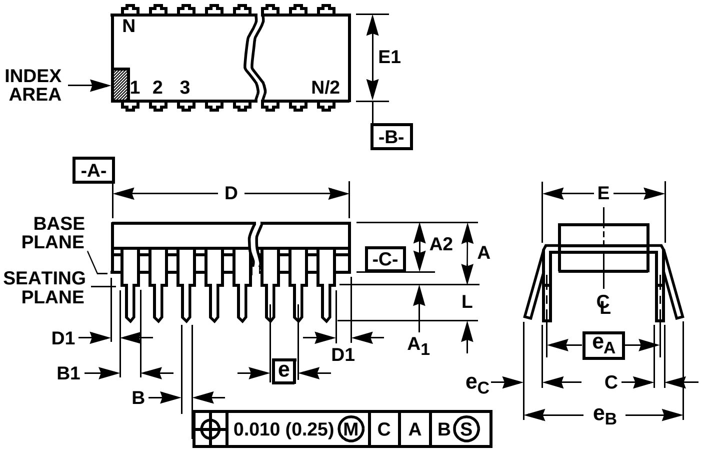
Bipolar Dielectric Isolation

Metallization Mask Layout

HA-2505



Dual-In-Line Plastic Packages (PDIP)



E8.3 (JEDEC MS-001-BA ISSUE D)
8 LEAD DUAL-IN-LINE PLASTIC PACKAGE

SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	-	0.210	-	5.33	4
A1	0.015	-	0.39	-	4
A2	0.115	0.195	2.93	4.95	-
B	0.014	0.022	0.356	0.558	-
B1	0.045	0.070	1.15	1.77	8, 10
C	0.008	0.014	0.204	0.355	-
D	0.355	0.400	9.01	10.16	5
D1	0.005	-	0.13	-	5
E	0.300	0.325	7.62	8.25	6
E1	0.240	0.280	6.10	7.11	5
e	0.100 BSC		2.54 BSC		-
e_A	0.300 BSC		7.62 BSC		6
e_B	-	0.430	-	10.92	7
L	0.115	0.150	2.93	3.81	4
N	8		8		9

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NOTES:

1. Controlling Dimensions: INCH. In case of conflict between English and Metric dimensions, the inch dimensions control.
2. Dimensioning and tolerancing per ANSI Y14.5M-1982.
3. Symbols are defined in the “MO Series Symbol List” in Section 2.2 of Publication No. 95.
4. Dimensions A, A1 and L are measured with the package seated in JEDEC seating plane gauge GS-3.
5. D, D1, and E1 dimensions do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.010 inch (0.25mm).
6. E and $\boxed{e_A}$ are measured with the leads constrained to be perpendicular to datum $\boxed{\text{-C-}}$.
7. e_B and e_C are measured at the lead tips with the leads unconstrained. e_C must be zero or greater.
8. B1 maximum dimensions do not include dambar protrusions. Dambar protrusions shall not exceed 0.010 inch (0.25mm).
9. N is the maximum number of terminal positions.
10. Corner leads (1, N, N/2 and N/2 + 1) for E8.3, E16.3, E18.3, E28.3, E42.6 will have a B1 dimension of 0.030 - 0.045 inch (0.76 - 1.14mm).