Data Sheet May 1999 File Number 3690.7

64ns Sample and Hold Amplifier

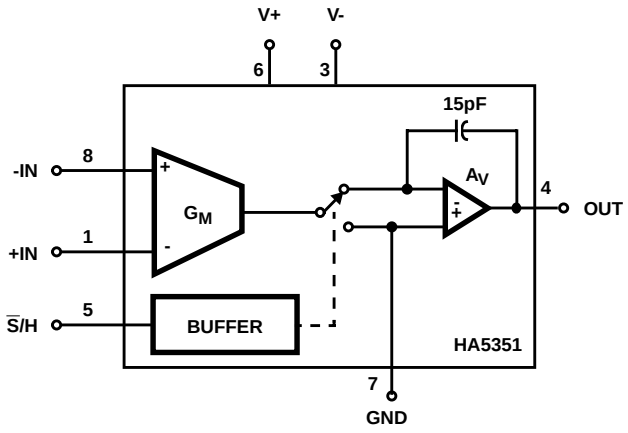
The HA5351 is a fast acquisition, wide bandwidth sample and hold amplifier, built with the Intersil HBC-10 BiCMOS process. This sample and hold amplifier offers a combination of desirable features; fast acquisition time (70ns to 0.01% maximum), excellent DC precision and extremely low power dissipation, making it ideal for use in systems that sample multiple signals and require low power.

The HA5351 is in an open loop configuration with fully differential inputs providing flexibility for user defined feedback. In unity gain the HA5351 is completely self-contained and requires no external components. The on-chip 15pF hold capacitor is completely isolated to minimizing droop rate and reduce sensitivity to pedestal error. The HA5351 is available in 8 lead PDIP and SOIC packages for minimizing board space and ease of layout.

Ordering Information

PART NUMBER (BRAND)	TEMP. RANGE (^{O}C)	PACKAGE	PKG. NO.
HA5351IP	-40 to 85	8 Ld PDIP	E8.3
HA5351IB (H5351)	-40 to 85	8 Ld SOIC	M8.15

Functional Diagram



Features

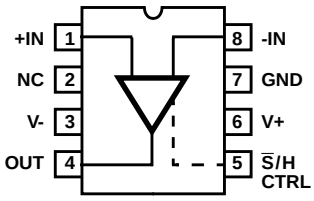
- Fast Acquisition to 0.01% . . . . . 70ns (Max)
- Low Offset Error . . . . . ±2mV (Max)
- Low Pedestal Error . . . . . ±10mV (Max)
- Low Droop Rate . . . . . 2µV/µs (Max)
- Wide Unity Gain Bandwidth 40MHz
- Low Power Dissipation . . . . . 220mW (Max)
- Total Harmonic Distortion (Hold Mode) . . . . . -72dBc - (V_{IN} = $5V_{P-P}$ at 1MHz)
- Fully Differential Inputs
- On Chip Hold Capacitor

Applications

- Synchronous Sampling
- Wide Bandwidth A/D Conversion
- Deglitching
- Peak Detection
- High Speed DC Restore

Pinout

HA5351
(PDIP, SOIC)
TOP VIEW)



Absolute Maximum Ratings

Voltage Between V+ and V- Terminals . . . . . +11V
Differential Input Voltage 6V
Voltage Between Sample and Hold Control and Ground . . . . . +5.5V
Output Current, Continuous . . . . . ±37mA

Operating Conditions

Temperature Range . . . . . -40^{o}C to 85^{o}C

Thermal Information

Thermal Resistance (Typical, Note 1)	θ_{JA} (^{o}C/W)
PDIP Package	120
SOIC Package	160

Maximum Junction Temperature (Plastic Package) . . . . . 150^{o}C
Maximum Storage Temperature Range . . . . . -65^{o}C to 150^{o}C
Maximum Lead Temperature (Soldering 10s) . . . . . 300^{o}C
(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.

NOTE:

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

Electrical Specifications

Test Conditions: V_{SUPPLY} = ±5V; C_H = Internal = 15pF, Digital Input: V_{IL} = fc0V (Sample), V_{IH} = 4.0V (Hold). Non-Inverting Unity Gain Configuration (Output Tied to -Input), C_L = 5pF, Unless Otherwise Specified

PARAMETER	TEST CONDITIONS	TEMP. (^{o}C)	HA5351I			UNITS
			MIN	TYP	MAX	
INPUT CHARACTERISTICS						
Input Voltage Range		Full	-2.5	-	+2.5	V
Input Resistance (Note 2)		25	100	500	-	kΩ
Input Capacitance		25	-	-	5	pF
Input Offset Voltage		25	-2	-	2	mV
		Full	-3.0	-	3.0	mV
Offset Voltage Temperature Coefficient		Full	-	15	-	µV/^{o}C
Bias Current		Full	-	2.5	5	µA
Offset Current		Full	-1.5	-	+1.5	µA
Common Mode Range		Full	-2.5	-	+2.5	V
Common Mode Rejection Ratio	±2.5V, Note 3	Full	60	80	-	dB
TRANSFER CHARACTERISTICS						
Large Signal Voltage Gain	V_{OUT} = ±2.5V	25	95	108	-	dB
		Full	85	-	-	dB
Unity Gain -3dB Bandwidth		25	-	40	-	MHz
TRANSIENT RESPONSE						
Rise Time	200mV Step	25	-	8.5	-	ns
Overshoot	200mV Step	25	0	-	30	%
Slew Rate	5V Step	Full	88	105	-	V/µs
DIGITAL INPUT CHARACTERISTICS						
Input Voltage	V_{IH}	25, 85	2.1	-	5.0	V
		-40	2.4	-	5.0	V
	V_{IL}	Full	0	-	0.8	V
Input Current	V_{IL} = 0V	Full	-1.0	-	1.0	µA
	V_{IH} = 5V	Full	-1.0	-	1.0	µA
OUTPUT CHARACTERISTICS						
Output Voltage	R_L = 510Ω	Full	-3.0	-	+3.0	V
Output Current	R_L = 100Ω	25, 85	20	25	-	mA
		-40	15	-	-	mA

Electrical Specifications Test Conditions: V_{SUPPLY} = ±5V; C_H = Internal = 15pF, Digital Input: V_{IL} = fc0V (Sample), V_{IH} = 4.0V (Hold). Non-Inverting Unity Gain Configuration (Output Tied to -Input), C_L = 5pF, Unless Otherwise Specified **(Continued)**

PARAMETER	TEST CONDITIONS	TEMP. (^oC)	HA5351I			UNITS
			MIN	TYP	MAX	
Full Power Bandwidth	$5V_{P-P}$, A_V = +1, -3dB	Full	-	13	-	MHz
Output Resistance	Hold Mode	25	-	0.02	-	Ω
Total Output Noise (DC to 10MHz)	Sample Mode	25	-	325	-	μV_{RMS}
	Hold Mode	25	-	325	-	μV_{RMS}
DISTORTION CHARACTERISTICS						
SAMPLE MODE						
Total Harmonic Distortion	V_{IN} = $4.5V_{P-P}$, f_{IN} = 100kHz	25	-	-80	-	dBc
	V_{IN} = $5V_{P-P}$, f_{IN} = 1MHz	25	-	-74	-	dBc
	V_{IN} = $1V_{P-P}$, f_{IN} = 10MHz	25	-	-57	-	dBc
Signal to Noise Ratio (RMS Signal to RMS Noise)	V_{IN} = $4.5V_{P-P}$, f_{IN} = 100kHz	25	-	73	-	dB
HOLD MODE (50% Duty Cycle S/H)						
Total Harmonic Distortion	V_{IN} = $4.5V_{P-P}$, f_{IN} = 100kHz, $f_S \cong$ 100kHz	25	-	-78	-	dBc
	V_{IN} = $5V_{P-P}$, f_{IN} = 1MHz, $f_S \cong$ 1MHz	25	-	-72	-	dBc
	V_{IN} = $1V_{P-P}$, f_{IN} = 10MHz, $f_S \cong$ 1MHz	25	-	-51	-	dBc
Signal to Noise Ratio (RMS Signal to RMS Noise)	V_{IN} = $4.5V_{P-P}$, f_{IN} = 100kHz, $f_S \cong$ 100kHz	25	-	70	-	dB
SAMPLE AND HOLD CHARACTERISTICS						
Acquisition Time	0V to 2.0V Step to ±1mV	25	-	53	-	ns
	0V to 2.0V Step to 0.01% (±200μV)	25	-	64	70	ns
	-2.5V to +2.5V Step to 0.01% (±500μV)	25	-	90	100	ns
Droop Rate		25	-	0.3	-	μV/μs
		Full	-2	-	2	μV/μs
Hold Step Error	V_{IL} = 0V, V_{IH} = 4.0V, t_R = 5ns	Full	-10	-	+10	mV
Hold Mode Settling Time	To ±1mV	25	-	50	-	ns
Hold Mode Feedthrough	$5V_{P-P}$, 500kHz, Sine	25	-	72	-	dB
EADT (Effective Aperture Delay Time)		25	-	+1	-	ns
Aperture Time (Note 2)		25	-	10	-	ns
Aperture Uncertainty		25	-	10	20	ps
POWER SUPPLY CHARACTERISTICS						
Positive Supply Current		Full	-	20	22	mA
Negative Supply Current		Full	-	20	22	mA
PSRR	10% Delta	Full	60	74	-	dB

NOTES:

2. Derived from Computer Simulation only, not tested.
3. +CMRR is measured from 0V to +2.5V, -CMRR is measured from 0V to -2.5V.

Typical Performance Curves

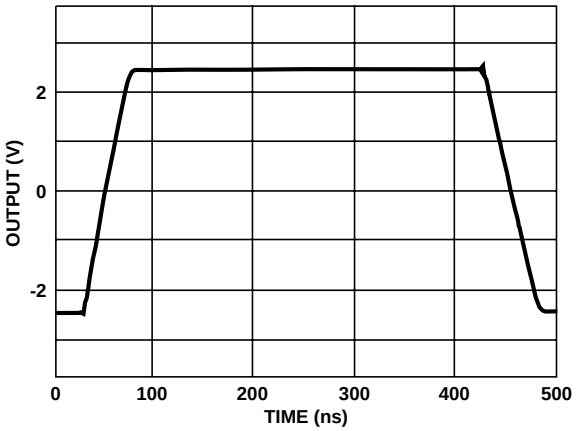


FIGURE 1. LARGE SIGNAL RESPONSE

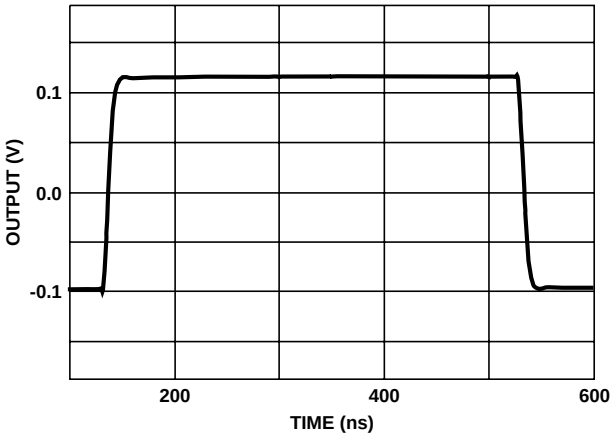


FIGURE 2. SMALL SIGNAL RESPONSE

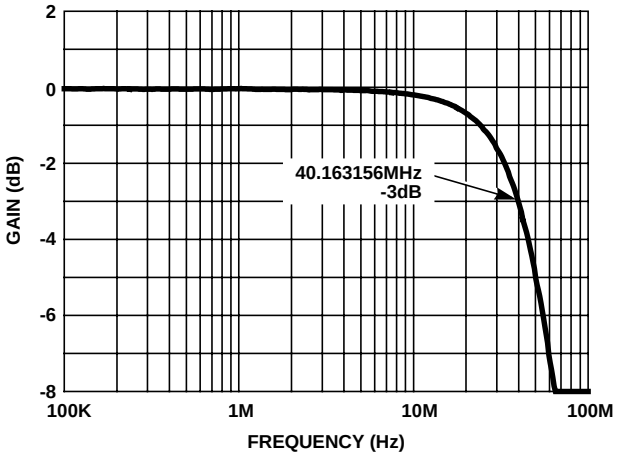


FIGURE 3. UNITY GAIN FREQUENCY RESPONSE

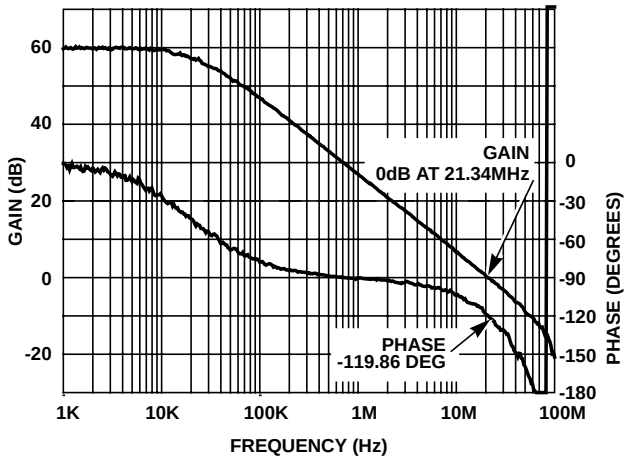


FIGURE 4. CLOSED LOOP GAIN/PHASE A_V = +1000

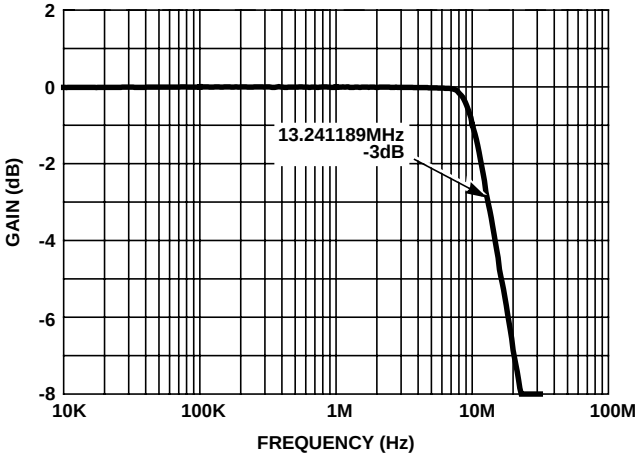


FIGURE 5. $5V_{P-P}$ FULL POWER FREQUENCY RESPONSE

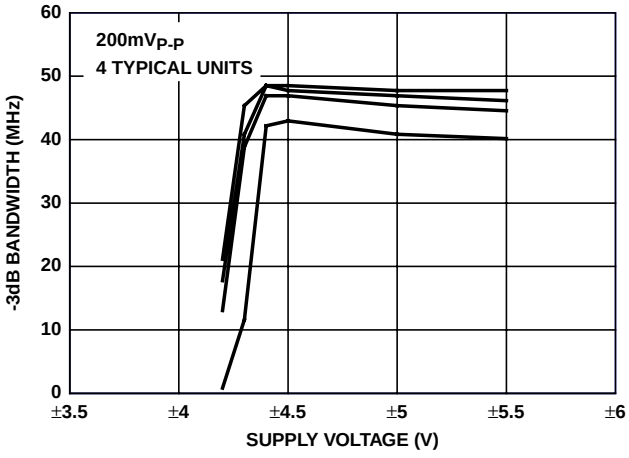


FIGURE 6. -3dB BANDWIDTH vs SUPPLY VOLTAGE

Typical Performance Curves (Continued)

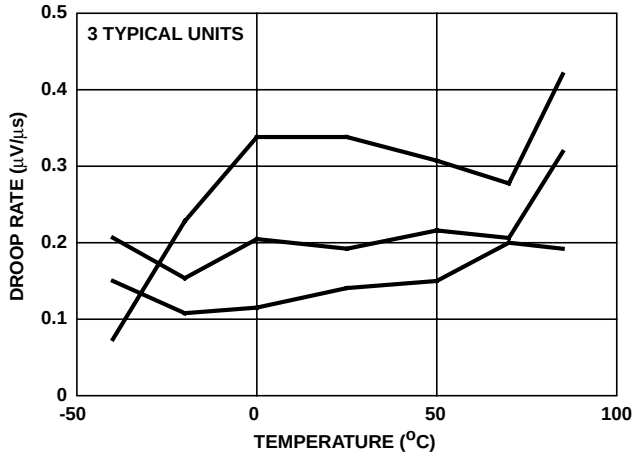


FIGURE 7. DROOP RATE vs TEMPERATURE

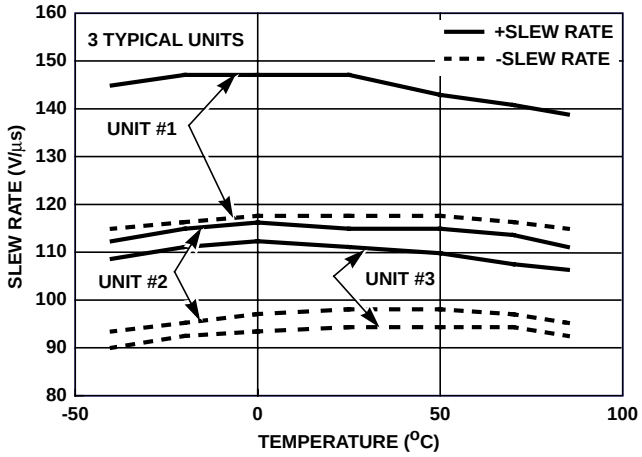


FIGURE 8. SLEW RATE vs TEMPERATURE

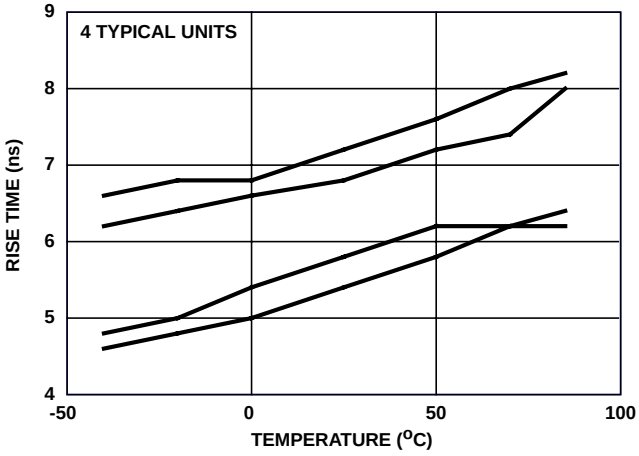


FIGURE 9. RISE TIME vs TEMPERATURE

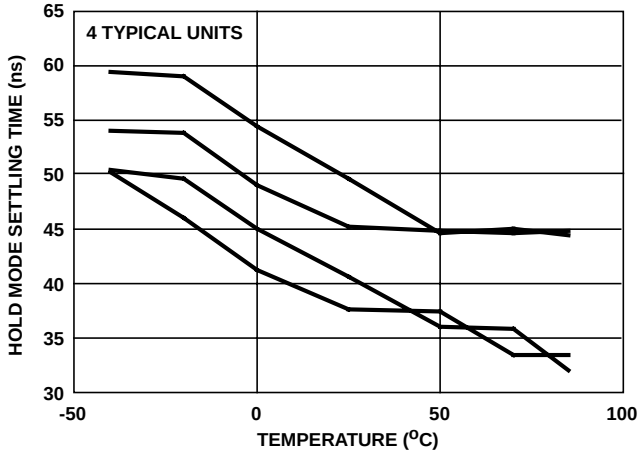


FIGURE 10. HOLD MODE SETTLING vs TEMPERATURE

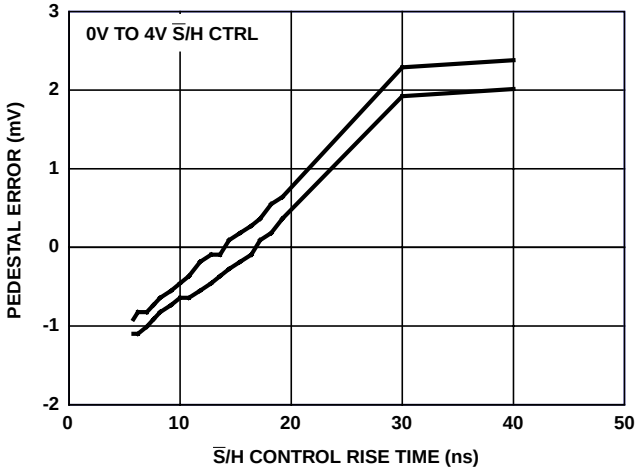


FIGURE 11. PEDESTAL vs S/H CONTROL RISE TIME

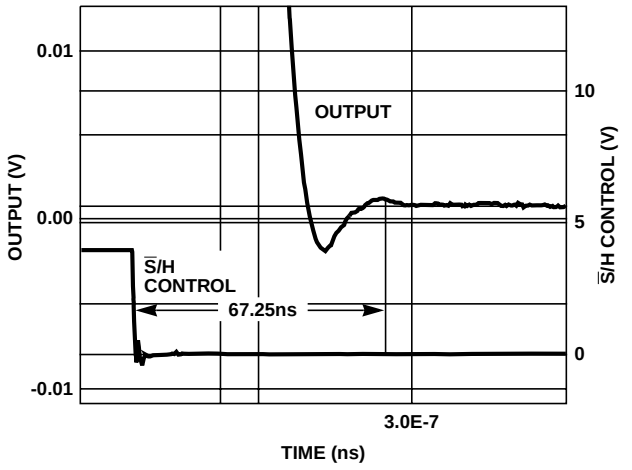


FIGURE 12. ACQUISITION TIME (0.01%, 0V TO 2V STEP)

Typical Performance Curves (Continued)

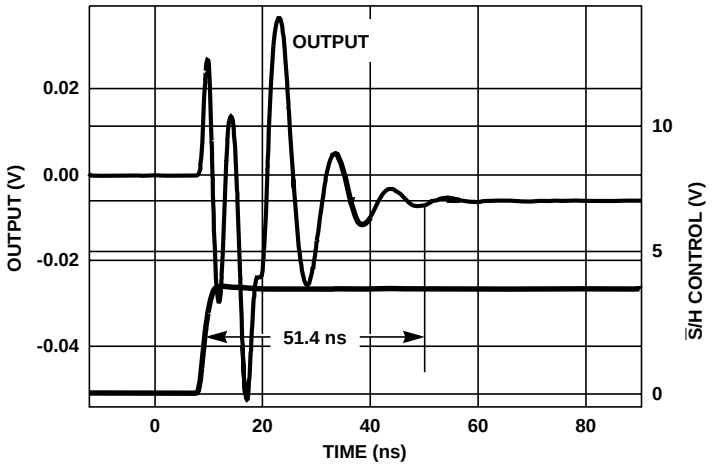


FIGURE 13. HOLD MODE SETTLING TIME (±200µV)

Die Characteristics

DIE DIMENSIONS:

2530µm x 1760µm x 525µm
100 mils x 69 mils x 19 mils

METALLIZATION:

Type: Metal 1: AlSiCu/TiW
Thickness: Metal 1: 6kÅ ±750Å
Type: Metal 2: AlSiCu
Thickness: Metal 2: 16kÅ ±1.1kÅ

PASSIVATION:

Type: Sandwich Passivation
Nitride - 4kÅ, Undoped Si Glass (USG) - 8kÅ,
Total - 12kÅ ±2kÅ

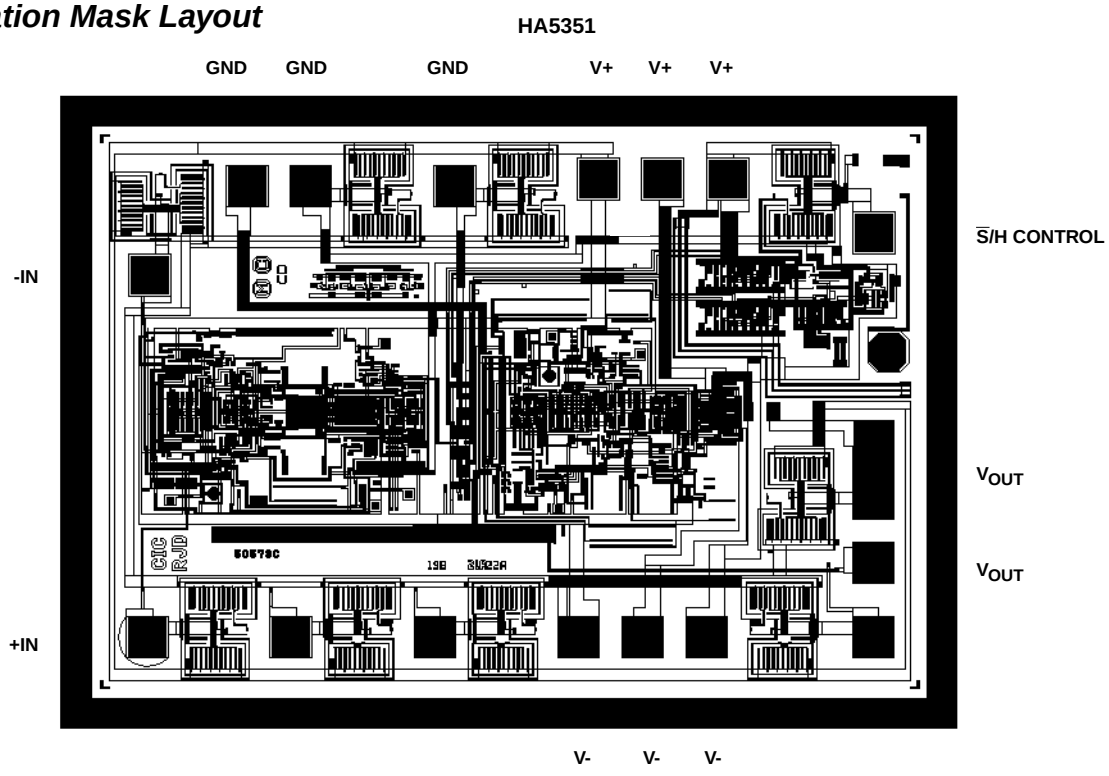
SUBSTRATE POTENTIAL:

V-

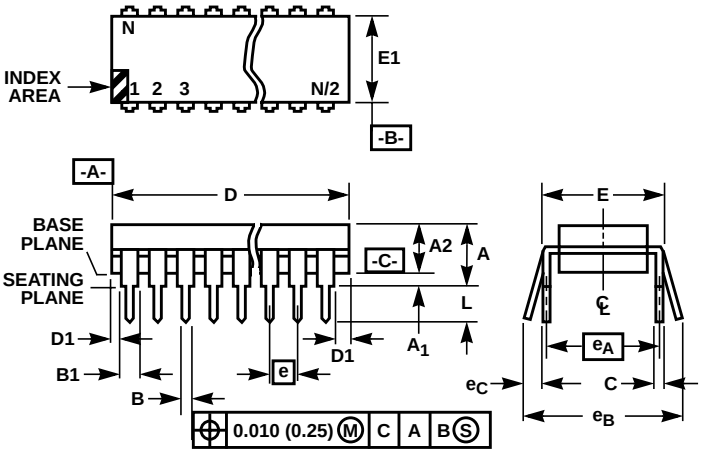
TRANSISTOR COUNT:

156

Metallization Mask Layout



Dual-In-Line Plastic Packages (PDIP)



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 e_A are measured with the leads constrained to be perpendicular to datum -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).

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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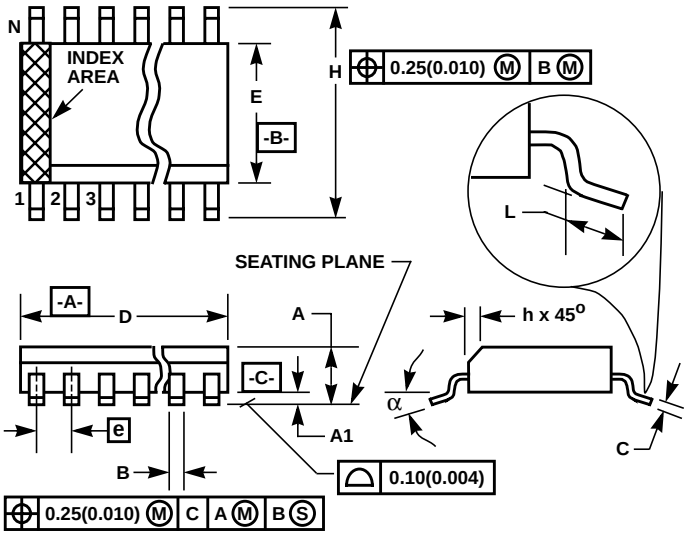
Small Outline Plastic Packages (SOIC)



NOTES:

1. Symbols are defined in the “MO Series Symbol List” in Section 2.2 of Publication Number 95.
2. Dimensioning and tolerancing per ANSI Y14.5M-1982.
3. Dimension “D” does not include mold flash, protrusions or gate burrs. Mold flash, protrusion and gate burrs shall not exceed 0.15mm (0.006 inch) per side.
4. Dimension “E” does not include interlead flash or protrusions. Interlead flash and protrusions shall not exceed 0.25mm (0.010 inch) per side.
5. The chamfer on the body is optional. If it is not present, a visual index feature must be located within the crosshatched area.
6. “L” is the length of terminal for soldering to a substrate.
7. “N” is the number of terminal positions.
8. Terminal numbers are shown for reference only.
9. The lead width “B”, as measured 0.36mm (0.014 inch) or greater above the seating plane, shall not exceed a maximum value of 0.61mm (0.024 inch).
10. Controlling dimension: MILLIMETER. Converted inch dimensions are not necessarily exact.

M8.15 (JEDEC MS-012-AA ISSUE C)
8 LEAD NARROW BODY SMALL OUTLINE PLASTIC PACKAGE

SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	0.0532	0.0688	1.35	1.75	-
A1	0.0040	0.0098	0.10	0.25	-
B	0.013	0.020	0.33	0.51	9
C	0.0075	0.0098	0.19	0.25	-
D	0.1890	0.1968	4.80	5.00	3
E	0.1497	0.1574	3.80	4.00	4
e	0.050 BSC		1.27 BSC		-
H	0.2284	0.2440	5.80	6.20	-
h	0.0099	0.0196	0.25	0.50	5
L	0.016	0.050	0.40	1.27	6
N	8		8		7
α	0^o	8^o	0^o	8^o	-

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