



Monolithic Transistor Array – SiS3046N

Silicon General Purpose x5 NPN Transistor array in PDIP-14

Rev 1.1
20/10/17

Description

The SiS3046N consists of five general purpose silicon NPN transistors on a common monolithic substrate. Two of the transistors are internally connected to form a differentially-connected pair. The transistors are well suited to a wide variety of applications in low power systems in the DC through VHF range. They may be used as discrete transistors in conventional circuits however; in addition, they provide the very significant inherent integrated circuit advantages of close electrical and thermal matching. The SiS3046N is a direct electrical & mechanical replacement for the obsolete National Semiconductor LM3046N.

Features:

- Two matched transistors:
 - V_{BE} Match $\pm 5\text{mA}$
 - I_{IO} Match $2\mu\text{A}$ (Max).
- Low Noise Figure 3.2dB (Typ) at 1kHz
- Operation From DC to 120MHz
- Wide Operating Current Range
- Full Military Temperature Range.

Ordering Information

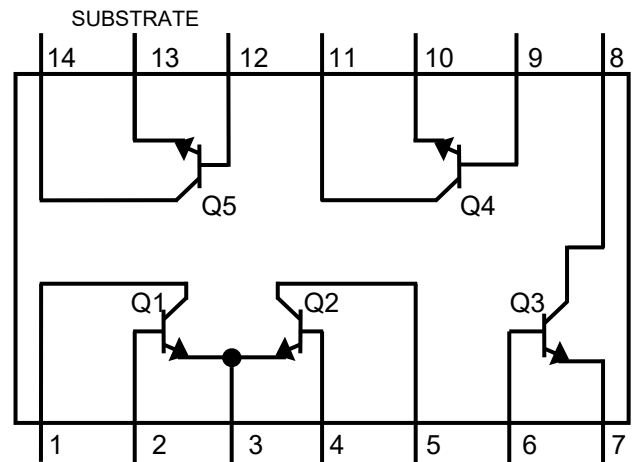
The following part suffixes apply:

SiS3046N - 14 Lead Plastic Dual-In-Line – RoHS compliant

Applications:

- Three Isolated Transistors and One Differentially Connected Transistor Pair for Low Power Applications at Frequencies from DC Through the VHF Range
- Custom Designed Differential Amplifiers
- Temperature Compensated Amplifiers.

Schematic & Connection Diagram



Absolute Maximum Ratings

PARAMETER	SYMBOL	VALUE	UNIT
Collector-to-Emitter Voltage	V_{CEO}	15	V
Collector-to-Base Voltage	V_{CBO}	20	V
Collector-to-Substrate Voltage (Note 1)	V_{CIO}	20	V
Emitter-to-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	50	mA
Maximum Power Dissipation (Any one transistor)	P_D	300	mW
Operating Temperature Range	-	-55 to 125	$^{\circ}\text{C}$
Maximum Junction Temperature	T_J	175	$^{\circ}\text{C}$





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DC Electrical Characteristics $T_A = 25^\circ\text{C}$ unless otherwise stated

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Collector to Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 10\mu\text{A}, I_E = 0$	20	60	-	V
Collector to Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 1\text{mA}, I_B = 0$	15	24	-	V
Collector-to-Substrate Breakdown Voltage	$V_{(BR)CIO}$	$I_C = 10\mu\text{A}, I_{CI} = 0$	20	60	-	V
Emitter to Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\mu\text{A}, I_C = 0$	5	7	-	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 10\text{V}, I_E = 0$	-	0.002	40	nA
Collector Cutoff Current (Figure 2)	I_{CEO}	$V_{CE} = 10\text{V}, I_B = 0$	-	FIG 2	0.5	μA
Forward Current Transfer Ratio (Static Beta) (Note 3) (Figure 3)	h_{FE}	$V_{CE} = 3\text{V}, I_C = 10\text{mA}$	-	100	-	-
		$V_{CE} = 3\text{V}, I_C = 1\text{mA}$	40	100	-	-
		$V_{CE} = 3\text{V}, I_C = 10\mu\text{A}$	-	54	-	-
Input Offset Current for Matched Pair Q1 and Q2. (Note 2) (Figure 4)	$ I_{IO1} - I_{IO2} $	$V_{CE} = 3\text{V}, I_C = 1\text{mA}$	-	0.3	2	μA
Base-to-Emitter Voltage (Note 2) (Figure 5)	V_{BE}	$V_{CE} = 3\text{V}, I_E = 1\text{mA}$	-	0.715	-	V
		$V_{CE} = 3\text{V}, I_E = 10\text{mA}$	-	0.800	-	
Magnitude of Input Offset Voltage for Differential Pair (Note 2) (Figures 5, 7)	$ V_{BE1} - V_{BE2} $	$V_{CE} = 3\text{V}, I_C = 1\text{mA}$	-	0.45	5	mV
Magnitude of Input Offset Voltage for Isolated Transistors. (Note 2) (Figures 5, 7)	$ V_{BE3} - V_{BE4} $ $ V_{BE4} - V_{BE5} $ $ V_{BE5} - V_{BE3} $	$V_{CE} = 3\text{V}, I_C = 1\text{mA}$	-	0.45	5	mV
Temperature Coefficient of Base-to-Emitter Voltage (Figure 6)	$\frac{\Delta V_{BE}}{\Delta T}$	$V_{CE} = 3\text{V}, I_C = 1\text{mA}$	-	-1.9	-	$\text{mV}/^\circ\text{C}$
Collector-to-Emitter Saturation Voltage	V_{CES}	$I_B = 1\text{mA}, I_C = 10\text{mA}$	-	0.23	-	V
Temperature Coefficient: Magnitude of Input Offset Voltage (Figure 7)	$\frac{ \Delta V_{IO} }{\Delta T}$	$V_{CE} = 3\text{V}, I_C = 1\text{mA}$	-	1.1	-	$\mu\text{V}/^\circ\text{C}$

Dynamic Electrical Characteristics $T_A = 25^\circ\text{C}$ unless otherwise stated

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Low Frequency Noise Figure (Figure 9)	NF	$f = 1\text{kHz}, V_{CE} = 3\text{V}$ $I_C = 100\mu\text{A}, \text{Source Resistance} = 1\text{k}\Omega$	-	3.25	-	dB
Low Frequency, Small Signal Equivalent Circuit Characteristics						
Forward Current Transfer Ratio (Figure 11)	h_{FE}	$f = 1\text{kHz}$ $V_{CE} = 3\text{V}, I_C = 1\text{mA}$	-	110	-	-
Short Circuit Input Impedance (Figure 11)	h_{iE}	$f = 1\text{kHz}$ $V_{CE} = 3\text{V}, I_C = 1\text{mA}$	-	3.5	-	$\text{k}\Omega$
Open Circuit Output Impedance (Figure 11)	h_{oE}	$f = 1\text{kHz}$ $V_{CE} = 3\text{V}, I_C = 1\text{mA}$	-	15.6	-	μmho
Open Circuit Reverse Voltage Transfer Ratio (Figure 11)	h_{rE}	$f = 1\text{kHz}$ $V_{CE} = 3\text{V}, I_C = 1\text{mA}$	-	1.8×10^{-4}	-	-





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Dynamic Electrical Characteristics continued $T_A = 25^\circ\text{C}$ unless otherwise stated

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PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Admittance Characteristics						
Forward Transfer Admittance (Figure 12)	Y_{FE}	$f = 1 \text{ kHz}$ $V_{CE} = 3\text{V}, I_C = 1\text{mA}$	-	31 - j1.5	-	-
Input Admittance (Figure 13)	Y_{IE}	$f = 1 \text{ kHz}$ $V_{CE} = 3\text{V}, I_C = 1\text{mA}$	-	0.3 + j0.04	-	-
Output Admittance (Figure 14)	Y_{OE}	$f = 1 \text{ kHz}$ $V_{CE} = 3\text{V}, I_C = 1\text{mA}$	-	0.001+j0.03	-	-
Reverse Transfer Admittance (Figure 15)	Y_{RE}	$f = 1 \text{ kHz}$ $V_{CE} = 3\text{V}, I_C = 1\text{mA}$	-	Fig 14	-	-
Gain Bandwidth Product (Figure 16)	f_T	$V_{CE} = 3\text{V}, I_C = 1\text{mA}$	300	550	-	MHz
Emitter-to-Base Capacitance	C_{EB}	$V_{EB} = 3\text{V}, I_E = 0$	-	0.6	-	pF
Collector-to-Base Capacitance	C_{CB}	$V_{CB} = 3\text{V}, I_C = 0$	-	0.58	-	pF
Collector-to-Substrate Capacitance	C_{CI}	$V_{CS} = 3\text{V}, I_C = 0$	-	2.8	-	pF

Notes: 1. Each transistor collector is isolated from the substrate by an integral diode. The substrate (Pin 13) must be connected to the most negative point in the external circuit to maintain isolation between transistors & normal transistor action. 2. Actual forcing current is via the emitter for this test.

Typical Performance Characteristics

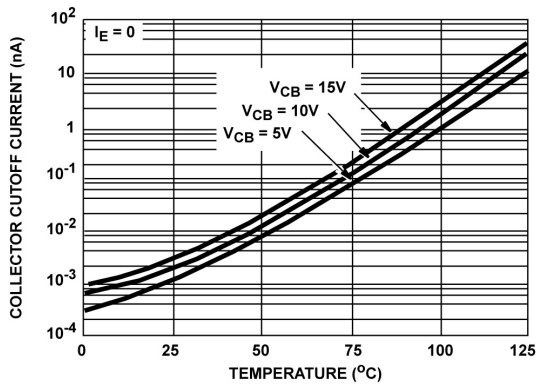


FIGURE 1. Base-To-Collector Current vs Temperature

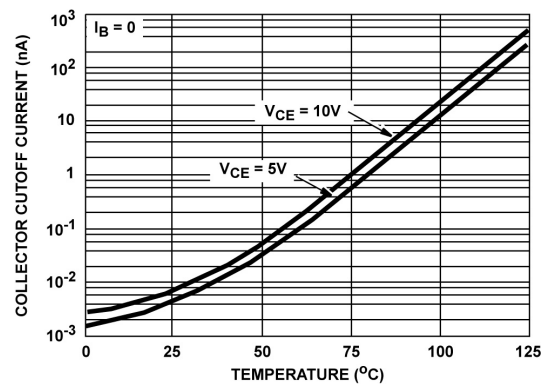


FIGURE 2. Collector-To-Emitter Cutoff Current vs Temperature

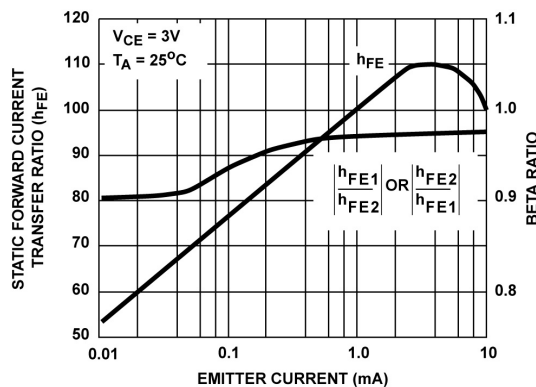


FIGURE 3. Static Forward Current Transfer Ratio & Beta Ratio for Q_1 and Q_2 vs Emitter Current

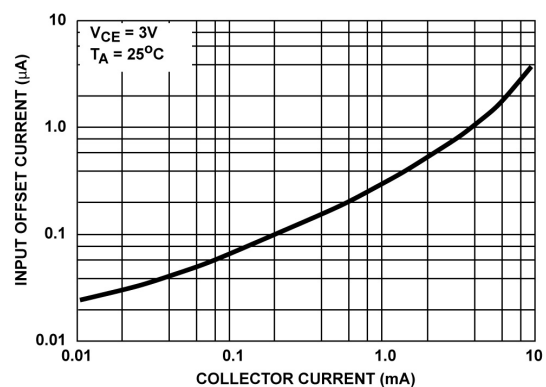


FIGURE 4. Input Offset Current for matched transistor pair Q_1Q_2 vs Collector Current





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Typical Performance Characteristics (Continued)

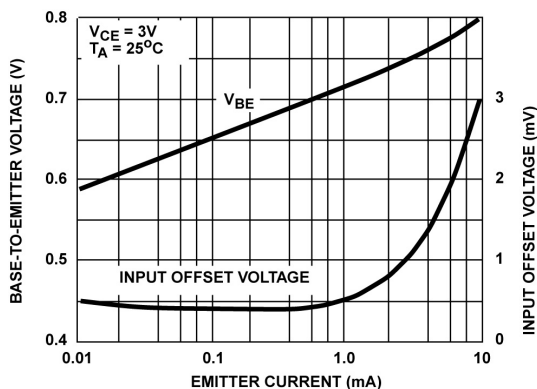


FIGURE 5. Static Base-to-Emitter Voltage characteristics and Input Offset Voltage for differential pair and paired isolated transistors vs Emitter Current

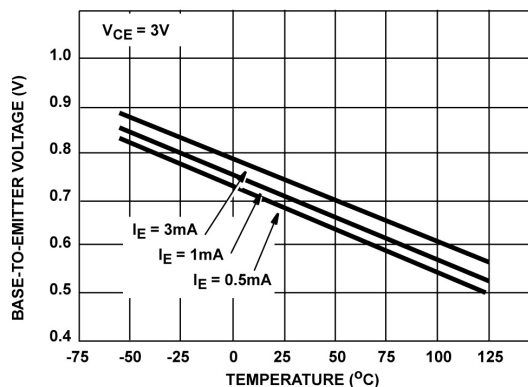


FIGURE 6. Base-to-Emitter Voltage characteristic vs Temperature for each transistor.

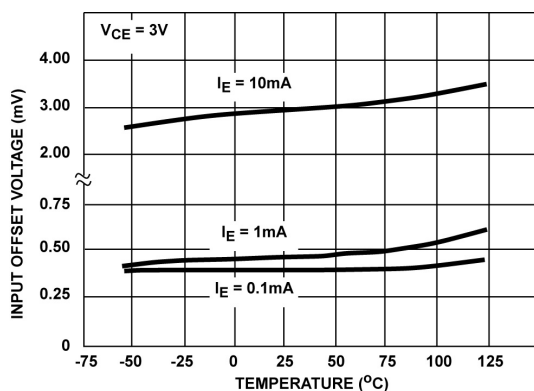


FIGURE 7. Input Offset Voltage characteristics for differential pair and paired isolated transistors vs Temperature

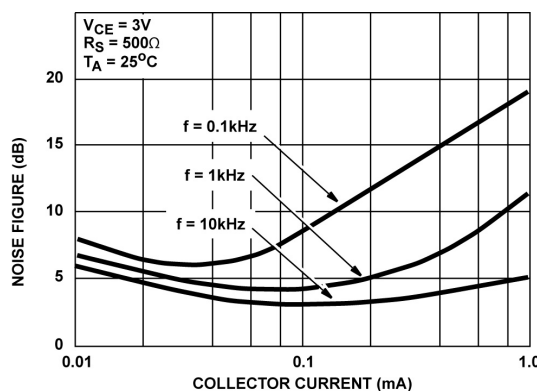


FIGURE 8. Noise Figure vs Collector Current

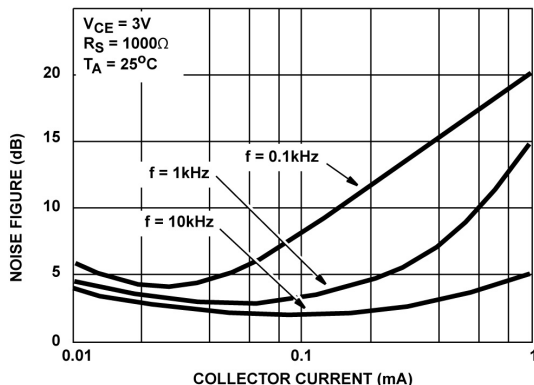


FIGURE 9. Noise Figure vs Collector Current

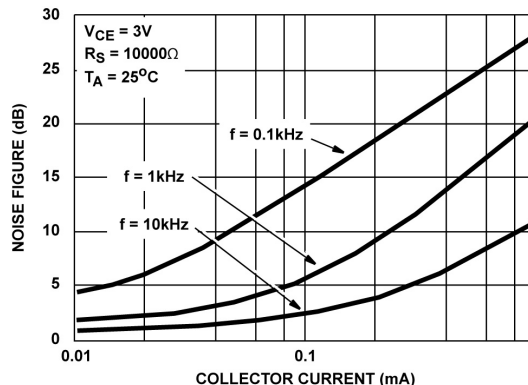


FIGURE 10. Noise Figure vs Collector Current





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Typical Performance Characteristics (Continued)

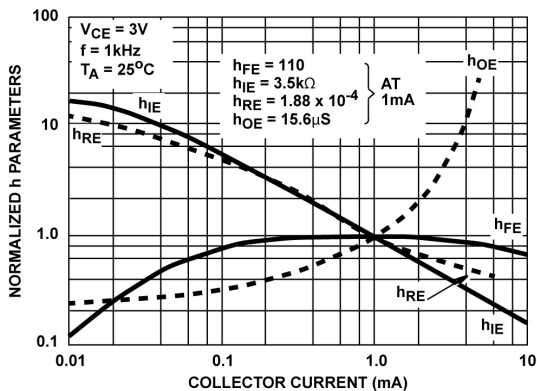


FIGURE 11. Normalized Forward Current Transfer ratio, Short Circuit Input Impedance, Open Circuit Output Impedance, And Open Circuit Reverse Voltage Transfer Ratio vs Collector Current

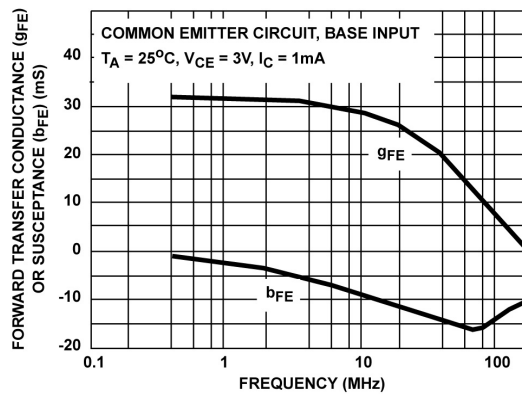


FIGURE 12. Forward Transfer Admittance vs Frequency

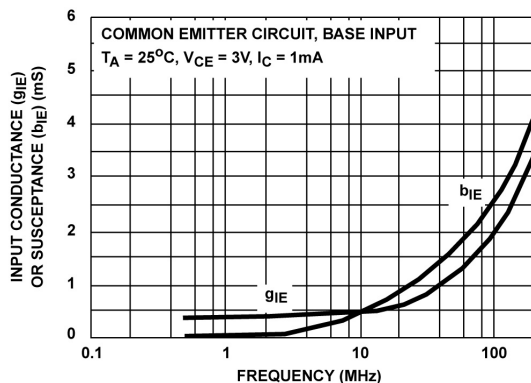


FIGURE 13. Input Admittance vs Frequency

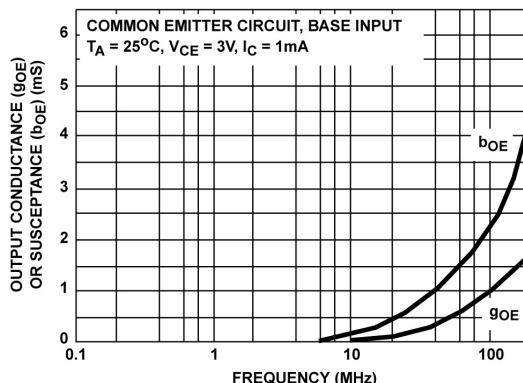


FIGURE 14. Output Admittance vs Frequency

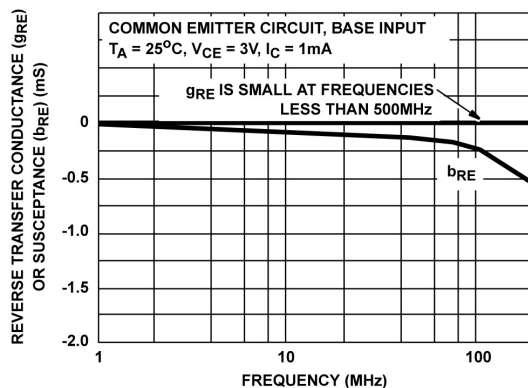


FIGURE 15. Typical Reverse Transfer Admittance vs Frequency

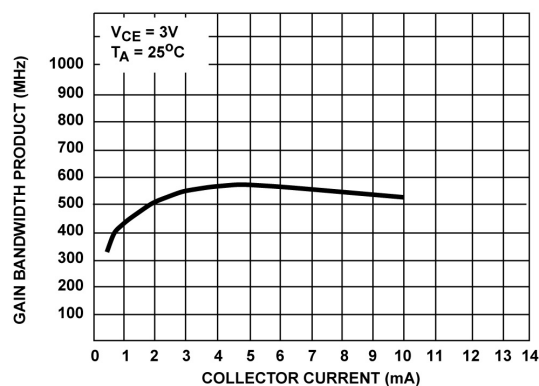


FIGURE 16. Typical Gain Bandwidth Product vs Collector Current

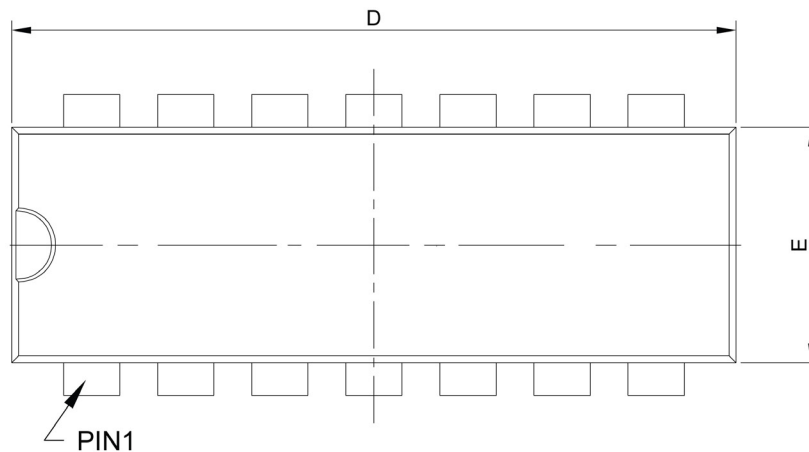
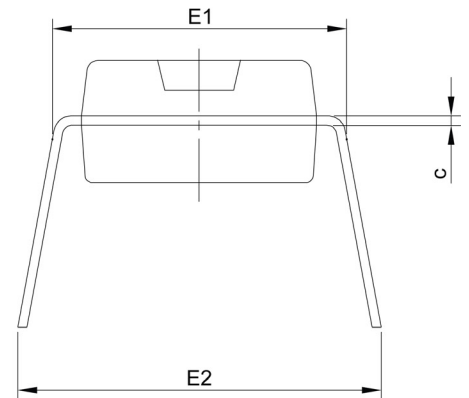
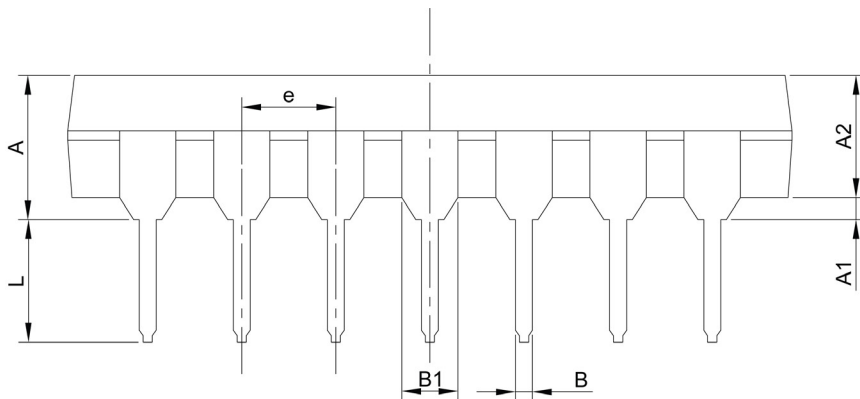




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14 Lead Plastic DIP - Package Dimensions and Footprint



PKG. DIMENSIONS(MM)		
SYMBOL	Min	Max
A	3.71	4.31
A1	0.51	
A2	3.20	3.60
B	0.38	0.57
B1	1.52 BSC	
c	0.20	0.36
D	18.80	19.20
E	6.20	6.60
E1	7.32	7.92
e	2.54 BSC	
L	3.00	3.60
E2	8.40	9.00

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