Matched NPN transistor pair

Features

• "Ideal" and identical transistors	
• Common-mode rejection ratio	> 120dB
• Emitter-base offset voltage	< 100μV
• Emitter-base offset voltage temperature drift	0,1μV/°C
• Current gain (h_{FE}) matched	< 2%
• Parameters are guaranteed in the range of collector current of	10μA to 1mA
• Noise Voltage Density of	1,8 nV /√Hz
• Ideal logarithmic properties	

AS194H,
AS394H,
AS394CH

AS194DE
AS394DE,
AS394CDE

General Description

The AS194 and AS394 are junction isolated ultra well-matched monolithic NPN transistor pairs with an order of magnitude improvement in matching over conventional transistor pairs.

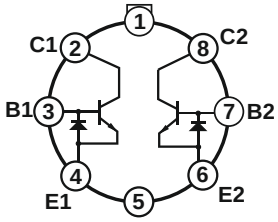
Electrical characteristics of these devices such as drift versus initial offset voltage, noise, and the exponential relationship of base-emitter voltage to collector current closely approach those of a theoretical transistor. Extrinsic base and emitter resistances is very low, giving very low noise and operating over a wide current range.

To guarantee long term stability of matching parameters, internal clamp diodes have been added across the emitter-base junction of each transistor. These prevent degradation due to reverse biased emitter current-the most common cause of field failures in matched devices. The parasitic isolation junction formed by the diodes also clamps the substrate region to the most negative emitter to ensure complete isolation between devices.

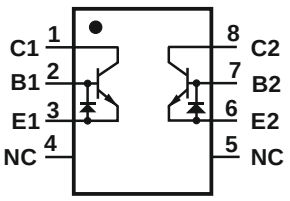
The AS194H, AS394H, AS394CH are available in the 8-pin metal can TO5-8 package and the AS394DE and AS394CDE in the 8-lead plastic SOIC-8 (150mil) EPAD package.

Connection Diagram

Top View



AS194H,
AS394H,
AS394CH
Metal Can Package
(TO5-8)



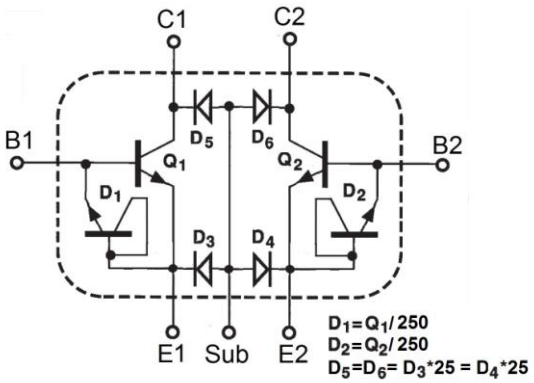
AS194DE
AS394DE,
AS394CDE

SOIC-8 (150mil) / EPAD

Pin Information

Pins number Package type		Symbol	Description
TO5-8	SOIC-8/ EPAD		
1	4	NC	Not connected
2	1	C1	Collector1
3	2	B1	Base1
4	3	E1	Emitter1
5	5	NC	Not connected
6	6	E2	Emitter2
7	7	B2	Base2
8	8	C2	Collector2
	EPAD		Isolated from Substrate

Simplified schematics of AS194/394



Absolute Maximum Ratings

• Collector Current		20mA
• Collector-Emitter Voltage	AS194, AS394	40V
	AS394C	20V
• Collector-Base Voltage	AS194, AS394	40V
	AS394C	20V
• Collector-Substrate Voltage	AS194, AS394	40V
	AS394C	20V
• Collector-Collector Voltage	AS194, AS394	40V
	AS394C	20V
• Base-Emitter Current		10mA

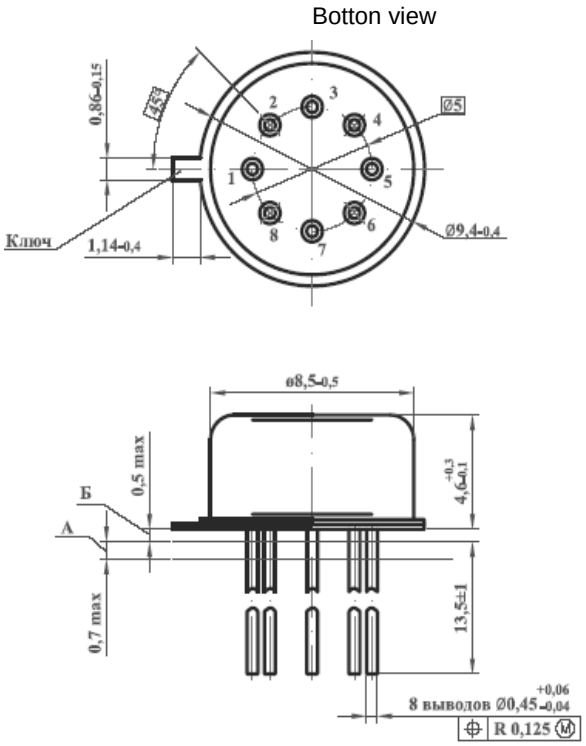
.

Electrical performance characteristics

Parameter, units	Conditions	AS194H AS194DE			AS394H AS394DE			AS394CH AS394CDE		
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max
Current Gain (h_{FE})	U_{CB} =0 V до U_{MAX} (Note1) I_C=1 mA I_C=100 µA I_C=10 µA I_C=1 µA	 350 350 300	 700 550 450 300		 300 250 200	 700 550 450 300		 250 230 150	 500 400 300 200	
Current Gain Match, $\Delta h_{FE\,1,2} = 100[\Delta I_B]\,[h_{FE(MIN)}] / I_C$, %	U_{CB}= 0 V to U_{MAX} I_C=10 µA to I_C=1 mA		0,5	2		0,5	4		1	5
Emitter-Base Offset Voltage, µV	U_{CB} = 0 V I_C=10 µA to I_C=1 mA		25	100			150			200
Change in Emitter-Base Offset Voltage vs Collector-Base Voltage (CMRR), µV	(Note1) I_C=10 µA to I_C=1 mA U_{CB} = 0 V to U_{MAX}		10	25		10	50		10	100
Change in Emitter-Base Offset Voltage vs Collector Current, µV	U_{CB} = 0 V I_C=10 µA to 1 mA		5	25		5	50		5	50
Collector-Base Leakage, nA	U_{CB} = U_{MAX}		0,05	0,3		0,05	0,5		0,05	0,5
Collector- Collector Leakage, nA	U_{CC}= U_{MAX}		1	2			5			5
Input Voltage Noise, nV /√Hz	U_{CB}=0 V, I_C=100 µA f = 100 Hz - 100 kHz		1,8				1,8		1,8	
Collector to Emitter Saturation Voltage, V	I_C=1 mA, I_B=10 µA I_C=1 mA, I_B=100 µA		0,2 0,1	0,25 0,15	- -	0,2 0,1	0,25 0,15		0,2 0,1	0,25 0,15

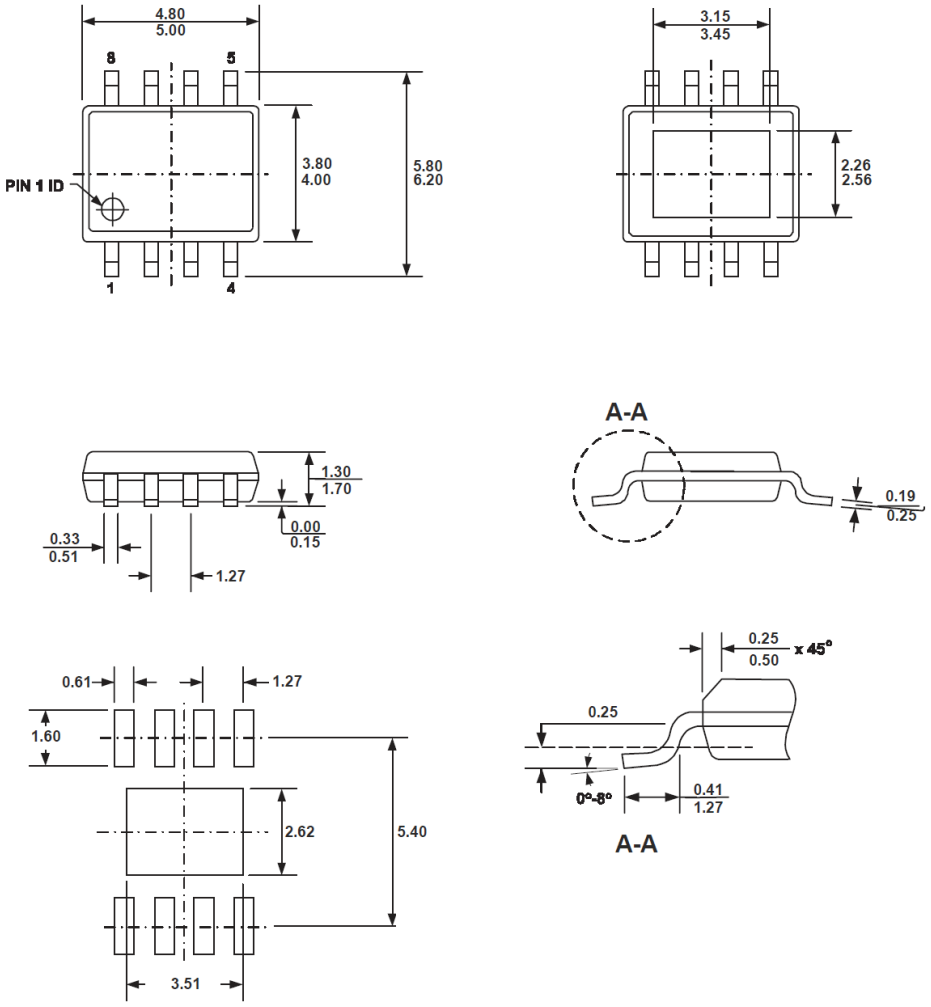
Note 1: Collector-base voltage is swept from 0 to U_{MAX}=35V at a collector current of 10 µA, 100 µA and 1 mA.
Note 2: Offset voltage drift with V_{OS} = 0 at T_A = 25°C is valid only when the ratio of I_{C1} to I_{C2} is adjusted to give the initial zero offset. This ratio must be held to within 0.003% over the entire temperature range. Measurements taken at +25 C and temperature extremes.
Note 3: Logging conformity is measured by computing the best fit to a true exponential and expressing the error as a base-emitter voltage deviation.

Package Dimensions in millimeters



8-lead T0-5 metal can package

Package Dimensions in millimeters (Continued)



SOIC-8 (150mil) EPAD

Revision history

Date	Revision	Changes
24-Jan-2018	**1**	Initial version
04-Feb-2019	**2**	Simplified schematics