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/$^{\circ}$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

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.
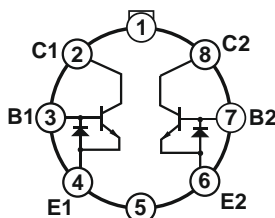
Electrical characteristics of these devices such as drift versus initial offset voltage, noise, and the exponential relationship of base-emitter voltage to collector current closely approach those of a theoretical transistor. Extrinsic base and emitter resistances are very low, giving very low noise 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, the AS194DE and AS394DE in the 8-lead plastic SOIC-8 (150mil) EPAD package.
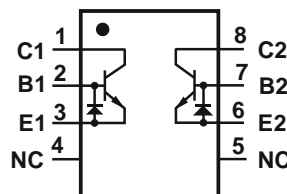
Connection Diagram

Top View
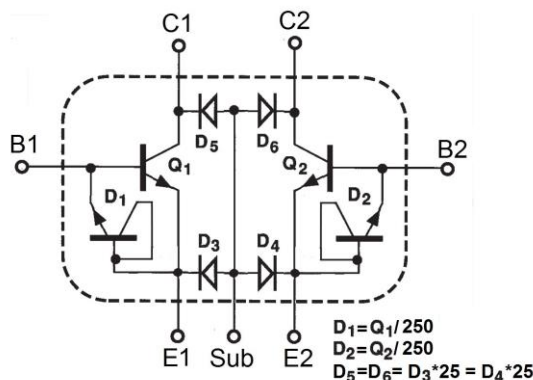

AS194H,
AS394H,
AS394CH

Metal Can Package (TO5-8)

AS194DE,
AS394DE

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		Don't connect

Simplified schematics of AS194/394

$D_1 = Q_1 / 250$
$D_2 = Q_2 / 250$
$D_5 = D_6 = D_3 \cdot 25 = D_4 \cdot 25$

Absolute Maximum Ratings

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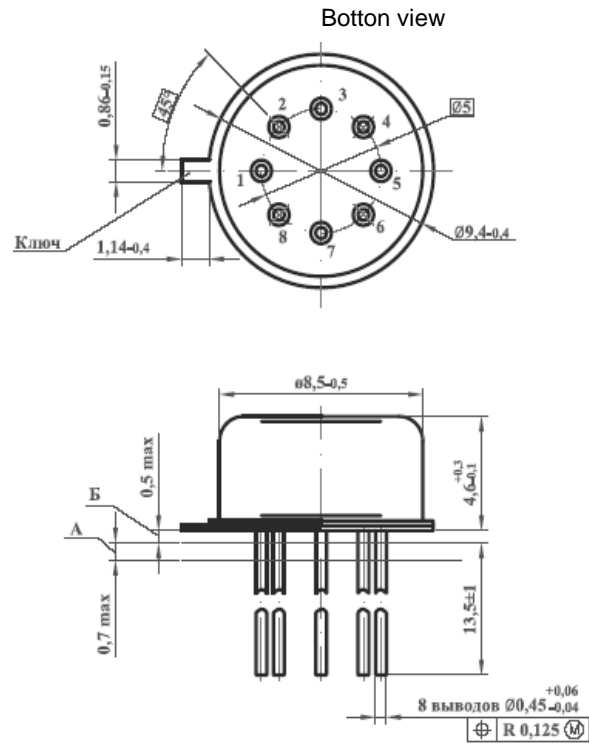- Collector-Emitter Voltage   AS194, AS394   40V
                                                AS394C   20V
- Collector-Base Voltage   AS194, AS394   40V
                                                AS394C   20V
- Collector-Substrate Voltage   AS194, AS394   40V
                                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

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Electrical performance characteristics

Parameter, units	Conditions	AS194H AS194DE			AS394H AS394DE			AS394CH		
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max
Current Gain (h_{FE})	U_{CB} =0V 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.
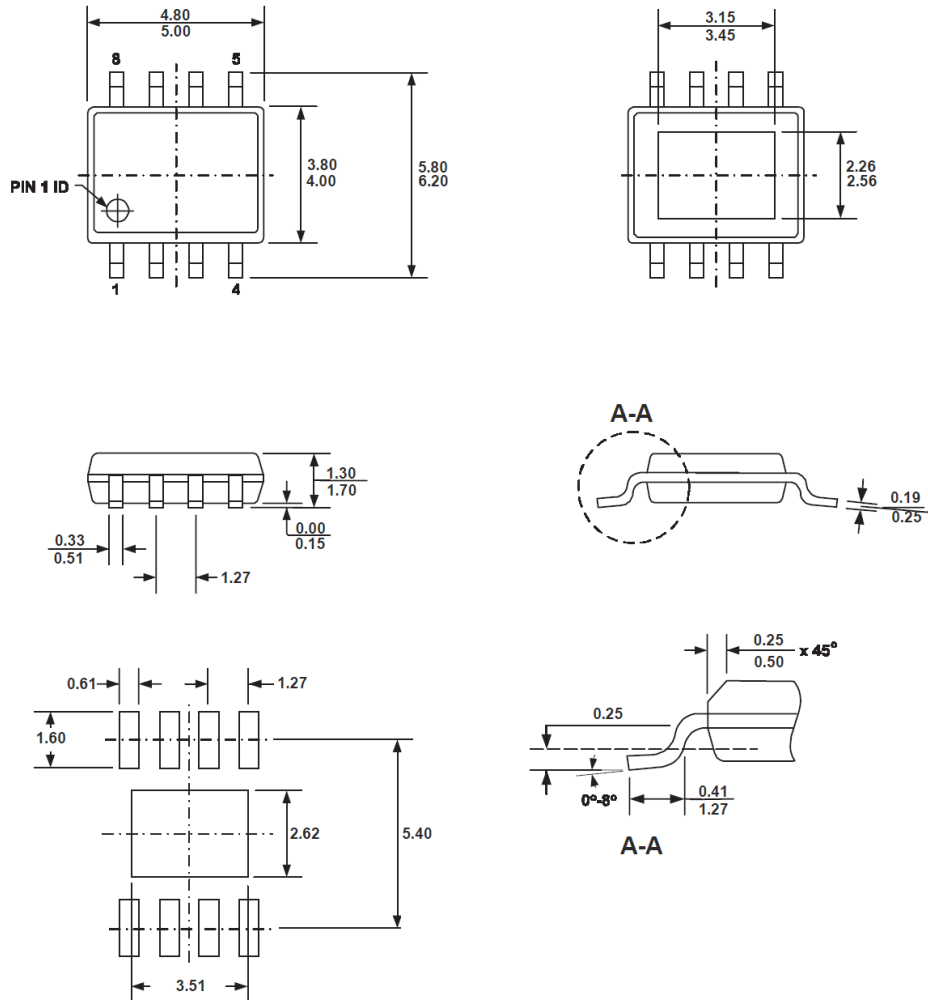
Package Dimensions in millimeters

Botton view

8-lead T0-5 metal can package

Marking

Device type	Package	Marking	Additional marking
AS194DE	SOIC-8 (150mil) EPAD	AS194DE	----
AS394DE	SOIC-8 (150mil) EPAD	AS194DE	white dot

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
30-Apr-2020	3	Explanation of the marking used
17-Mar-2023	4	EPAD connection changed