

Matched NPN transistor pair

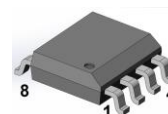
Features

- "Ideal" and identical transistors
- Common-mode rejection ratio $> 120\text{dB}$
- Emitter-base offset voltage $< 100\mu\text{V}$
- Emitter-base offset voltage temperature drift $0,1\mu\text{V}/^\circ\text{C}$
- Current gain (h_{FE}) matched $< 2\%$
- Parameters are guaranteed in the range of collector current of $10\mu\text{A}$ to 1mA
- Noise Voltage Density of $1,8\text{ nV}/\sqrt{\text{Hz}}$
- 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.

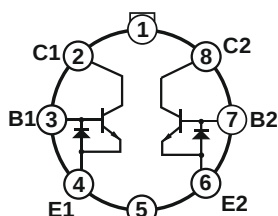
Electrical characteristics of these devices such as drift versus initial offset voltage, noise, and the exponential relationship of base-emitter voltage to collector current closely approach those of a theoretical transistor. Extrinsic base and emitter resistances are very low, giving very low noise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

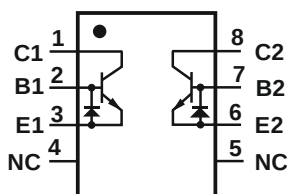
Connection Diagram

Top View



AS194H,
AS394H,
AS394CH

**Metal Can Package
(TO5-8)**



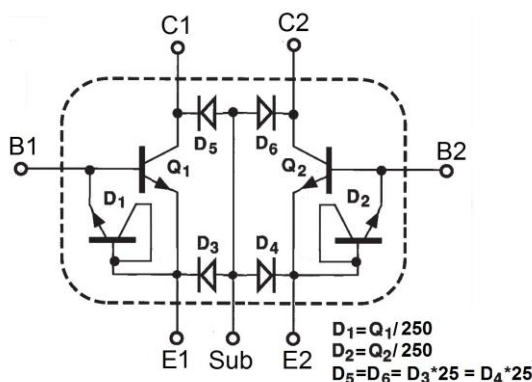
AS194DE,
AS394DE

**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





Absolute Maximum Ratings

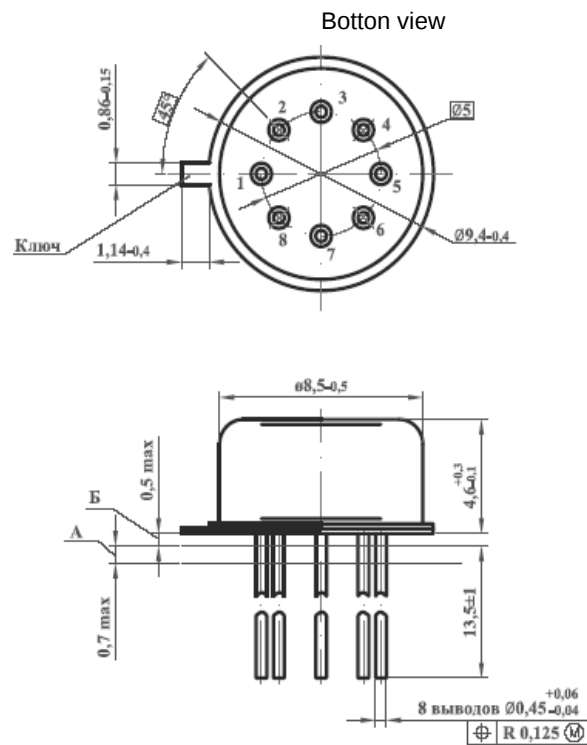
• Collector Current		20mA
• Collector-Emitter Voltage	AS194, AS394	40V
	AS394C	20V
• Collector-Base Voltage	AS194, AS394	40V
	AS394C	20V
• Collector-Substrate Voltage	AS194, AS394	40V
	AS394C	20V
• Collector-Collector Voltage	AS194, AS394	40V
	AS394C	20V
• Base-Emitter Current		10mA

Electrical performance characteristics

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



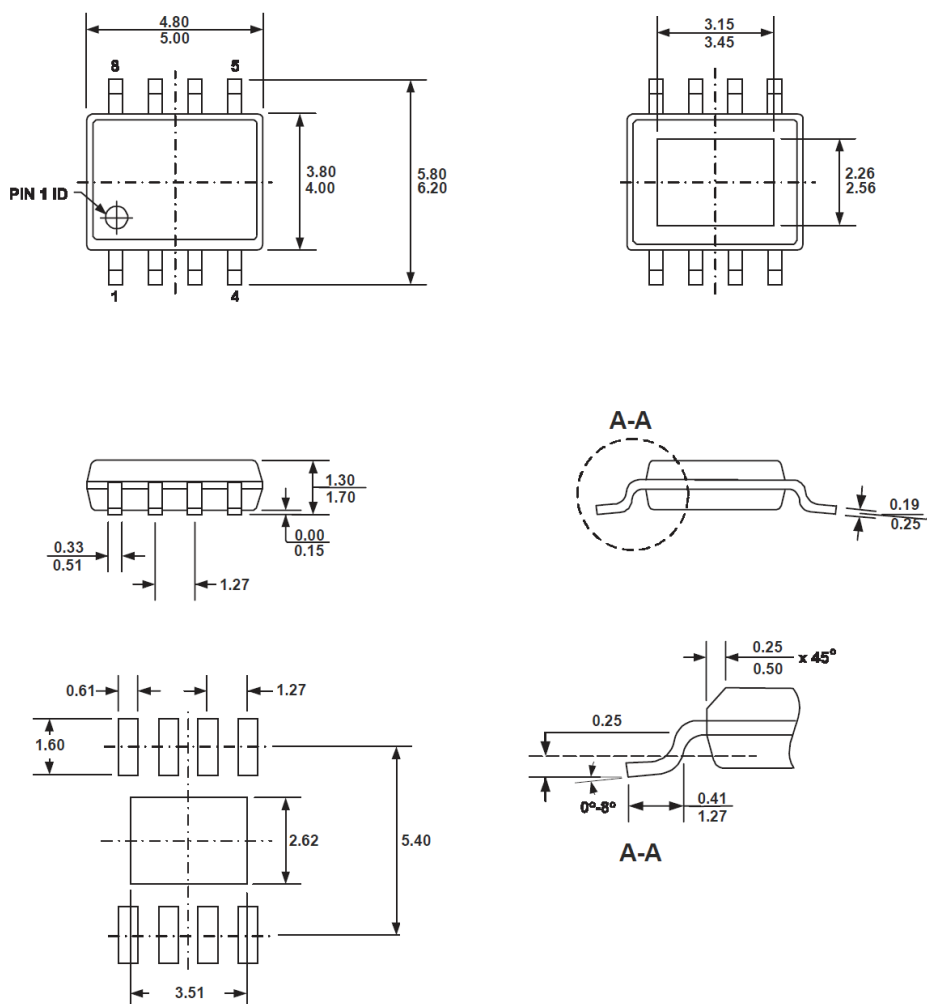
8-lead TO-5 metal can package



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