

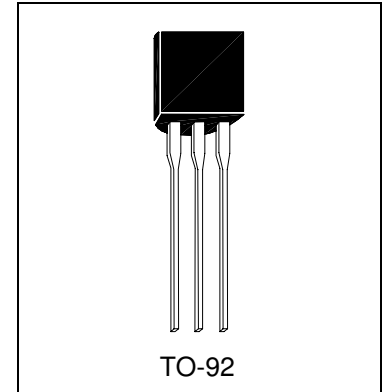


# HSD1609S

NPN EPITAXIAL PLANAR TRANSISTOR

## Description

The HSD1609S is designed for low frequency high voltage amplifier applications, complementary pair with HSB1109S.



## Absolute Maximum Ratings

- Maximum Temperatures
  - Storage Temperature ..... -50 ~ +150 °C
  - Junction Temperature ..... 150 °C Maximum
- Maximum Power Dissipation
  - Total Power Dissipation (T<sub>A</sub>=25°C) ..... 900 mW
- Maximum Voltages and Currents (T<sub>A</sub>=25°C)
  - V<sub>CBO</sub> Collector to Base Voltage ..... 160 V
  - V<sub>CEO</sub> Collector to Emitter Voltage ..... 160 V
  - V<sub>EBO</sub> Emitter to Base Voltage ..... 5 V
  - I<sub>C</sub> Collector Current ..... 100 mA

## Electrical Characteristics (T<sub>A</sub>=25°C)

| Symbol                | Min. | Typ. | Max. | Unit | Test Conditions                                 |
|-----------------------|------|------|------|------|---|
| BV <sub>CBO</sub>     | 160  | -    | -    | V    | I <sub>C</sub> =10uA, I <sub>E</sub> =0         |
| BV <sub>CEO</sub>     | 160  | -    | -    | V    | I <sub>C</sub> =1mA, I <sub>B</sub> =0          |
| BV <sub>EBO</sub>     | 5    | -    | -    | V    | I <sub>E</sub> =10uA, I <sub>C</sub> =0         |
| I <sub>CBO</sub>      | -    | -    | 10   | uA   | V <sub>CB</sub> =140V, I <sub>E</sub> =0        |
| *V <sub>CE(sat)</sub> | -    | -    | 2    | V    | I <sub>C</sub> =30mA, I <sub>B</sub> =3mA       |
| V <sub>BE(on)</sub>   | -    | -    | 1.5  | V    | V <sub>CE</sub> =5V, I <sub>C</sub> =10mA       |
| *h <sub>FE1</sub>     | 60   | -    | 320  |      | V <sub>CE</sub> =5V, I <sub>C</sub> =10mA       |
| *h <sub>FE2</sub>     | 30   | -    | -    |      | V <sub>CE</sub> =5V, I <sub>C</sub> =1mA        |
| f <sub>T</sub>        | -    | 140  | -    | MHz  | V <sub>CE</sub> =5V, I <sub>C</sub> =10mA       |
| Cob                   | -    | 3.8  | -    | pF   | I <sub>E</sub> =0, V <sub>CB</sub> =10V, f=1MHZ |

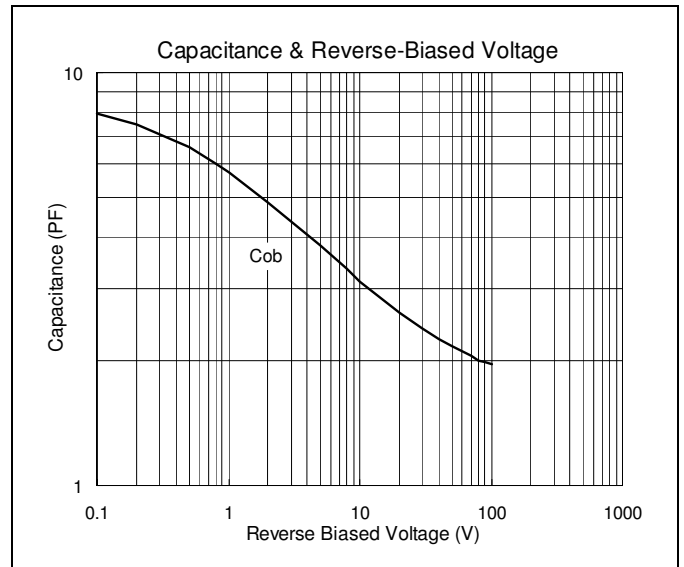
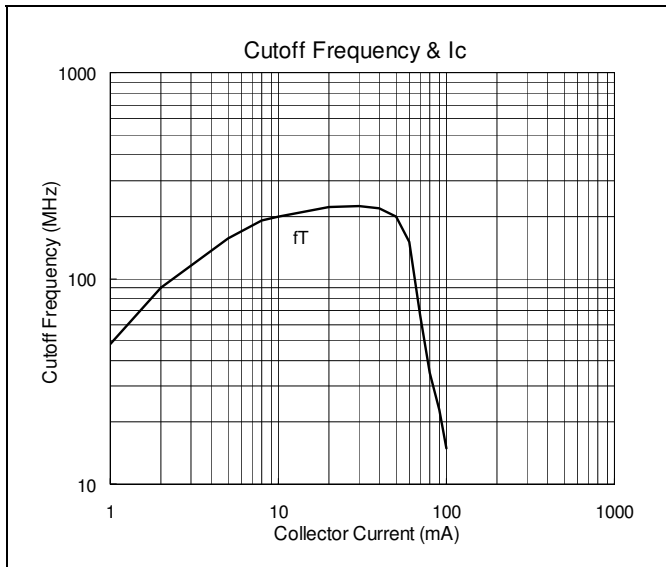
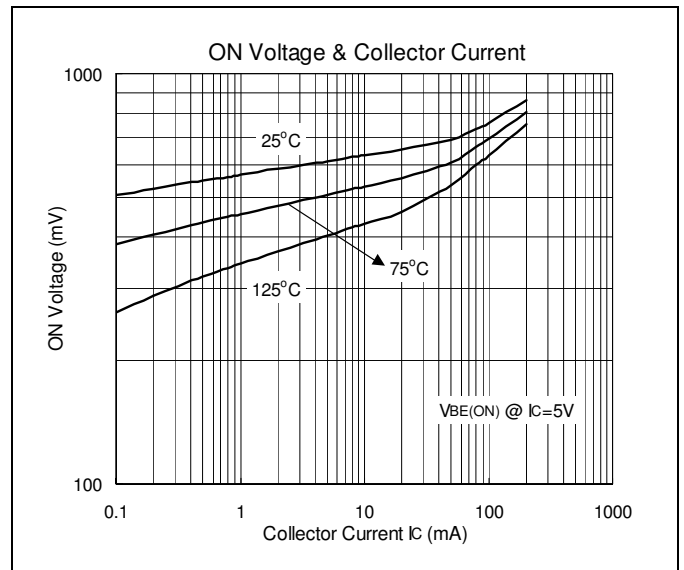
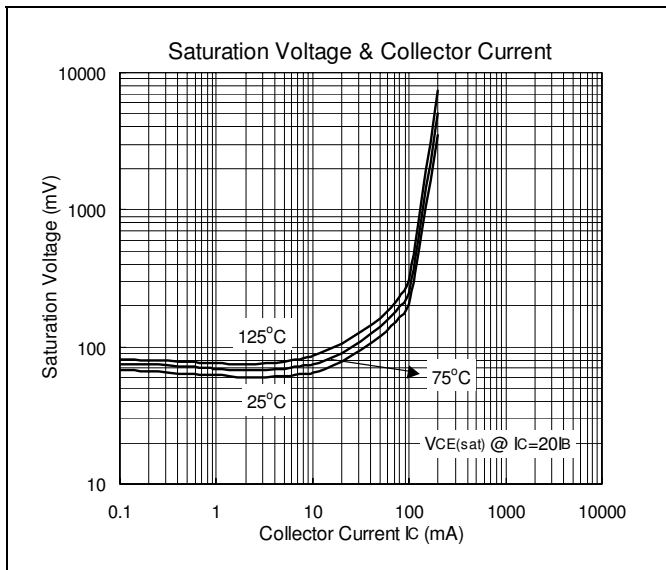
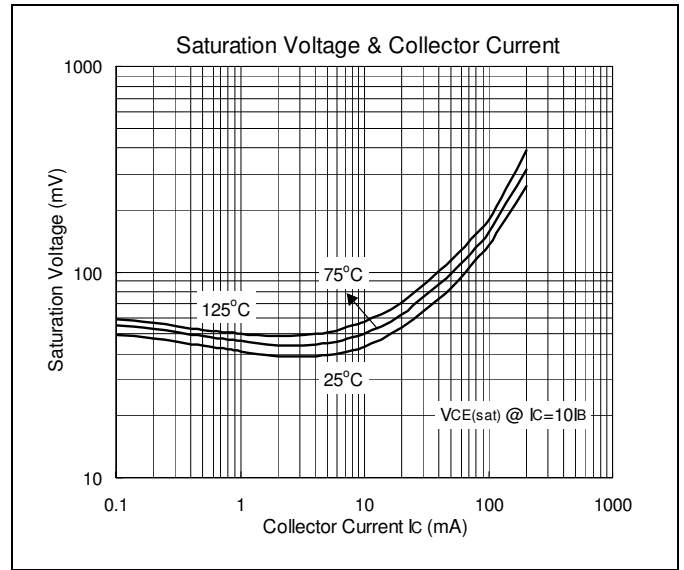
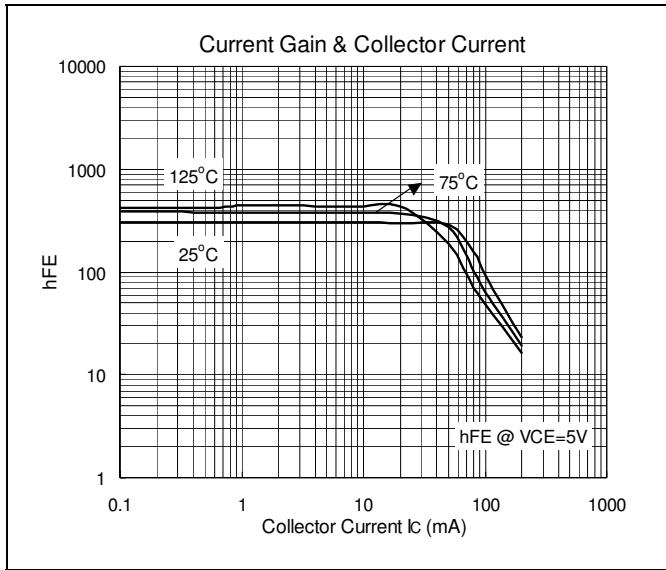
\*Pulse Test: Pulse Width ≤380us, Duty Cycle≤2%

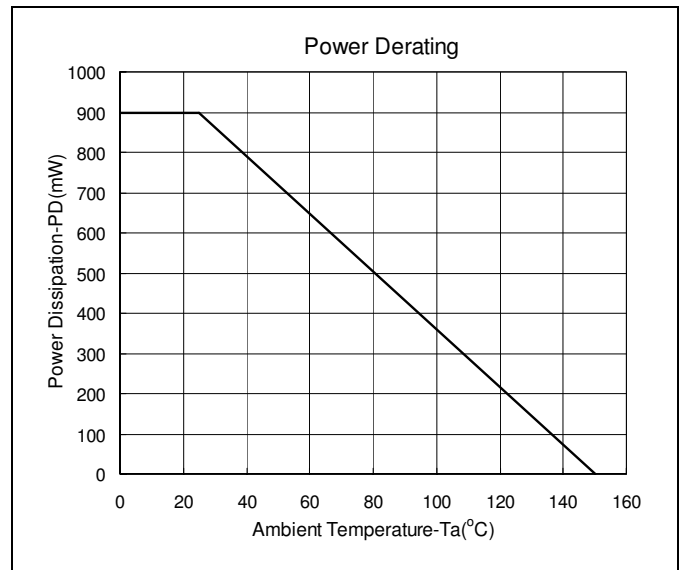
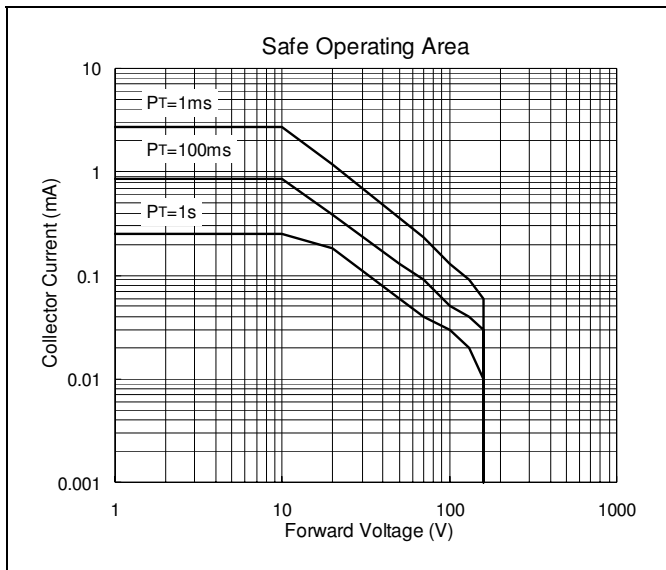
## Classification of h<sub>FE1</sub>

| Rank  | B      | C       | D       |
|-------|--------|---------|---------|
| Range | 60-120 | 100-200 | 160-320 |



### Characteristics Curve







### TO-92 Dimension

3-Lead TO-92 Plastic Package  
HSMC Package Code: A

**Marking:**

Pb Free Mark  
 Pb-Free: "●" (Note)  
 Normal: None

|   |   |   |
|---|---|---|
| H | S | D |
| 1 | 6 | 9 |
| S | S | S |

Date Code      Control Code

Note: Green label is used for pb-free packing  
 Pin Style: 1. Emitter 2. Collector 3. Base

**Material:**

- Lead solder plating: Sn60/Pb40 (Normal), Sn/3.0Ag/0.5Cu or Pure-Tin (Pb-free)
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0

| DIM        | Min.  | Max.  |
|------------|-------|-------|
| A          | 4.33  | 4.83  |
| B          | 4.33  | 4.83  |
| C          | 12.70 | -     |
| D          | 0.36  | 0.56  |
| E          | -     | *1.27 |
| F          | 3.36  | 3.76  |
| G          | 0.36  | 0.56  |
| H          | -     | *2.54 |
| I          | -     | *1.27 |
| $\alpha 1$ | -     | *5°   |
| $\alpha 2$ | -     | *2°   |
| $\alpha 3$ | -     | *2°   |

\*: Typical, Unit: mm

### TO-92 Taping Dimension

| DIM   | Min.  | Max.  |
|-------|-------|-------|
| A     | 4.33  | 4.83  |
| D     | 3.80  | 4.20  |
| D1    | 0.36  | 0.53  |
| D2    | 4.33  | 4.83  |
| F1,F2 | 2.40  | 2.90  |
| H     | 15.50 | 16.50 |
| H1    | 8.50  | 9.50  |
| H2    | -     | 1     |
| H2A   | -     | 1     |
| H3    | -     | 27    |
| H4    | -     | 21    |
| L     | -     | 11    |
| L1    | 2.50  | -     |
| P     | 12.50 | 12.90 |
| P1    | 5.95  | 6.75  |
| P2    | 50.30 | 51.30 |
| T     | -     | 0.55  |
| T1    | -     | 1.42  |
| T2    | 0.36  | 0.68  |
| W     | 17.50 | 19.00 |
| W1    | 5.00  | 7.00  |

Unit: mm

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### Soldering Methods for HSMC's Products

1. Storage environment: Temperature=10°C~35°C Humidity=65%±15%
2. Reflow soldering of surface-mount devices



| Profile Feature  | Sn-Pb Eutectic Assembly | Pb-Free Assembly |
|--|-------------------------|------------------|
| Average ramp-up rate (T <sub>L</sub> to T <sub>p</sub> )     | <3°C/sec                | <3°C/sec         |
| Preheat  |                         |                  |
| - Temperature Min (T <sub>smin</sub> )                       | 100°C                   | 150°C            |
| - Temperature Max (T <sub>smax</sub> )                       | 150°C                   | 200°C            |
| - Time (min to max) (ts)                                     | 60~120 sec              | 60~180 sec       |
| T <sub>smax</sub> to T <sub>L</sub>                          |                         |                  |
| - Ramp-up Rate   | <3°C/sec                | <3°C/sec         |
| Time maintained above:                                       |                         |                  |
| - Temperature (T <sub>L</sub> )                              | 183°C                   | 217°C            |
| - Time (t <sub>L</sub> )                                     | 60~150 sec              | 60~150 sec       |
| Peak Temperature (T <sub>p</sub> )                           | 240°C +0/-5°C           | 260°C +0/-5°C    |
| Time within 5°C of actual Peak Temperature (t <sub>p</sub> ) | 10~30 sec               | 20~40 sec        |
| Ramp-down Rate   | <6°C/sec                | <6°C/sec         |
| Time 25°C to Peak Temperature                                | <6 minutes              | <8 minutes       |

### 3. Flow (wave) soldering (solder dipping)

| Products         | Peak temperature | Dipping time |
|------------------|------------------|--------------|
| Pb devices.      | 245°C ±5°C       | 5sec ±1sec   |
| Pb-Free devices. | 260°C +0/-5°C    | 5sec ±1sec   |