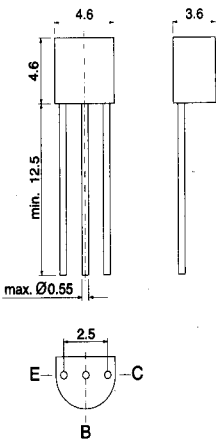


NPN Silicon Expitaxial Planar Transistor  
for switching and amplifier applications.

As complementary types the PNP transistors  
HN / 2N 3905 and HN / 2N 3906 are recommended.

On special request, these transistors can be manufactured  
in different pin configurations. Please refer to the “TO-92  
TRANSISTOR PACKAGE OUTLINE” on page 80 for the  
available pin options.



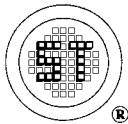
TO-92 Plastic Package  
Weight approx. 0.18 g  
Dimensions in mm

Absolute Maximum Ratings (T<sub>a</sub>= 25°C)

|                                              | Symbol           | Value             | Unit |
|----------------------------------------------|------------------|-------------------|------|
| Collector Base Voltage                       | V <sub>CBO</sub> | 60                | V    |
| Collector Emitter Voltage                    | V <sub>CEO</sub> | 40                | V    |
| Emitter Base Voltage                         | V <sub>EB0</sub> | 6                 | V    |
| Collector Current                            | I <sub>C</sub>   | 100               | mA   |
| Peak Collector Current                       | I <sub>CM</sub>  | 200               | mA   |
| Power Dissipation at T <sub>amb</sub> = 25°C | P <sub>tot</sub> | 500 <sup>1)</sup> | mW   |
| Junction Temperature                         | T <sub>J</sub>   | 150               | °C   |
| Storage Temperature Range                    | T <sub>s</sub>   | -55 to +150       | °C   |

<sup>1)</sup> Valid provided that leads are kept at ambient temperature at a distance of 2 mm from case

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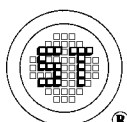


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( wholly owned subsidiary of HONEY TECHNOLOGY LTD. )



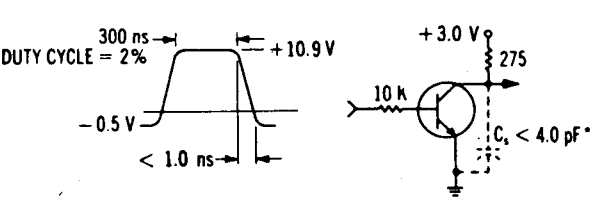
## Characteristics at $T_{amb} = 25\text{ }^{\circ}\text{C}$

|                                                                                                                                                                                                                                                                                 |              | Symbol              | Min. | Typ. | Max.              | Unit |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|---------------------|------|------|-------------------|------|
| DC Current Gain<br>at $V_{CE} = 1\text{ V}$ , $I_C = 0.1\text{ mA}$<br>at $V_{CE} = 1\text{ V}$ , $I_C = 1\text{ mA}$<br>at $V_{CE} = 1\text{ V}$ , $I_C = 10\text{ mA}$<br>at $V_{CE} = 1\text{ V}$ , $I_C = 50\text{ mA}$<br>at $V_{CE} = 1\text{ V}$ , $I_C = 100\text{ mA}$ | HN / 2N 3903 | $h_{FE}$            | 20   | -    | -                 | -    |
|                                                                                                                                                                                                                                                                                 | HN / 2N 3904 | $h_{FE}$            | 40   | -    | -                 | -    |
|                                                                                                                                                                                                                                                                                 | HN / 2N 3903 | $h_{FE}$            | 35   | -    | -                 | -    |
|                                                                                                                                                                                                                                                                                 | HN / 2N 3904 | $h_{FE}$            | 70   | -    | -                 | -    |
|                                                                                                                                                                                                                                                                                 | HN / 2N 3903 | $h_{FE}$            | 50   | -    | 150               | -    |
|                                                                                                                                                                                                                                                                                 | HN / 2N 3904 | $h_{FE}$            | 100  | -    | 300               | -    |
|                                                                                                                                                                                                                                                                                 | HN / 2N 3903 | $h_{FE}$            | 30   | -    | -                 | -    |
|                                                                                                                                                                                                                                                                                 | HN / 2N 3904 | $h_{FE}$            | 60   | -    | -                 | -    |
|                                                                                                                                                                                                                                                                                 | HN / 2N 3903 | $h_{FE}$            | 15   | -    | -                 | -    |
|                                                                                                                                                                                                                                                                                 | HN / 2N 3904 | $h_{FE}$            | 30   | -    | -                 | -    |
| Thermal Resistance Junction to Ambient                                                                                                                                                                                                                                          |              | $R_{thA}$           | -    | -    | 250 <sup>1)</sup> | K/W  |
| Collector Saturation Voltage<br>at $I_C = 10\text{ mA}$ , $I_B = 1\text{ mA}$<br>at $I_C = 50\text{ mA}$ , $I_B = 5\text{ mA}$                                                                                                                                                  |              | $V_{CE\text{ sat}}$ | -    | -    | 0.2               | V    |
|                                                                                                                                                                                                                                                                                 |              | $V_{CE\text{ sat}}$ | -    | -    | 0.3               | V    |
| Base Saturation Voltage<br>at $I_C = 10\text{ mA}$ , $I_B = 1\text{ mA}$<br>at $I_C = 50\text{ mA}$ , $I_B = 5\text{ mA}$                                                                                                                                                       |              | $V_{BE\text{ sat}}$ | -    | -    | 0.85              | V    |
|                                                                                                                                                                                                                                                                                 |              | $V_{BE\text{ sat}}$ | -    | -    | 0.95              | V    |
| Collector Cutoff Current<br>$V_{EB} = 3\text{ V}$ , $V_{CE} = 30\text{ V}$                                                                                                                                                                                                      |              | $I_{CEV}$           | -    | -    | 50                | nA   |
| Emitter Cutoff Current<br>$V_{EB} = 3\text{ V}$ , $V_{CE} = 30\text{ V}$                                                                                                                                                                                                        |              | $I_{EBV}$           | -    | -    | 50                | nA   |
| Collector Base Breakdown Voltage<br>at $I_C = 10\text{ }\mu\text{A}$ , $I_E = 0$                                                                                                                                                                                                |              | $V_{(BR)CBO}$       | 60   | -    | -                 | V    |
| Collector Emitter Breakdown Voltage<br>at $I_C = 1\text{ mA}$ , $I_B = 0$                                                                                                                                                                                                       |              | $V_{(BR)CEO}$       | 40   | -    | -                 | V    |
| Emitter Base Breakdown Voltage<br>at $I_E = 10\text{ }\mu\text{A}$ , $I_C = 0$                                                                                                                                                                                                  |              | $V_{(BR)EBO}$       | 6    | -    | -                 | V    |
| Gain Bandwidth Product<br>at $V_{CE} = 20\text{ V}$ , $I_C = 10\text{ mA}$ , $f = 100\text{ MHz}$                                                                                                                                                                               | HN / 2N 3903 | $f_T$               | 250  | -    | -                 | MHz  |
|                                                                                                                                                                                                                                                                                 | HN / 2N 3904 | $f_T$               | 300  | -    | -                 | MHz  |
| Collector Base Capacitance<br>at $V_{CB} = 5\text{ V}$ , $f = 100\text{ kHz}$                                                                                                                                                                                                   |              | $C_{CBO}$           | -    | -    | 4                 | pF   |
| Emitter Base Capacitance<br>at $V_{EB} = 0.5\text{ V}$ , $f = 100\text{ kHz}$                                                                                                                                                                                                   |              | $C_{EBO}$           | -    | -    | 8                 | pF   |
| <sup>1)</sup> Valid provided that leads are kept at ambient temperature at a distance of 2 mm from case.                                                                                                                                                                        |              |                     |      |      |                   |      |

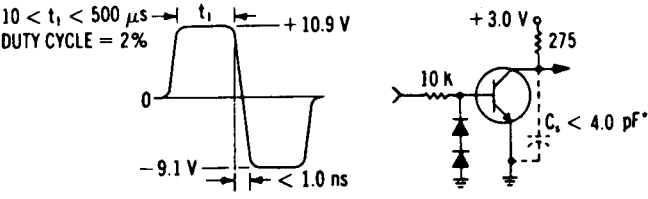


Characteristics (continued)

|                                                                                      | Symbol | Min. | Typ. | Max. | Unit |
|--------------------------------------------------------------------------------------|--------|------|------|------|------|
| Rise Time (see Fig. 1)<br>at $I_{B1} = 1\text{ mA}$ , $I_C = 10\text{ mA}$           | $t_r$  | -    | -    | 70   | ns   |
| Fall Time (see Fig. 2)<br>at $-I_{B1} = I_{B2} = 1\text{ mA}$ , $I_C = 10\text{ mA}$ | $t_f$  | -    | -    | 200  | ns   |



**Fig. 1:** Test circuit for delay and rise time  
\* total shunt capacitance of test jig and connectors



**Fig. 2:** Test circuit for storage and fall time  
\* total shunt capacitance of test jig and connectors

