

## Plastic-Encapsulate Transistors

DUAL TRANSISTOR (NPN+PNP)

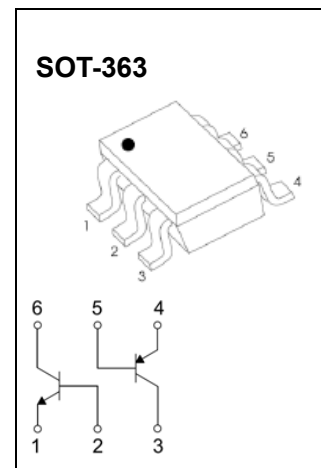
### FEATURES

- Complementary Pair
- One 3904-Type NPN  
One 3906-Type PNP
- Epitaxial Planar Die Construction
- Ideal for Low Power Amplification and Switching

**MAKING: K46**

**MAXIMUM RATINGS** ( $T_a=25^{\circ}\text{C}$  unless otherwise noted)

| Symbol    | Parameter                     | Value   | Units              |
|-----------|-------------------------------|---------|--------------------|
| $V_{CBO}$ | Collector-Base Voltage        | 60      | V                  |
| $V_{CEO}$ | Collector-Emitter Voltage     | 40      | V                  |
| $V_{EBO}$ | Emitter-Base Voltage          | 5       | V                  |
| $I_C$     | Collector Current -Continuous | 0.2     | A                  |
| $P_C$     | Collector Power Dissipation   | 0.2     | W                  |
| $T_J$     | Junction Temperature          | 150     | $^{\circ}\text{C}$ |
| $T_{stg}$ | Storage Temperature           | -55-150 | $^{\circ}\text{C}$ |



### NPN 3904 ELECTRICAL CHARACTERISTICS ( $T_a=25^{\circ}\text{C}$ unless otherwise specified)

| Parameter                            | Symbol         | Test conditions                                                          | Min  | Max  | Unit          |
|--------------------------------------|----------------|--------------------------------------------------------------------------|------|------|---------------|
| Collector-base breakdown voltage     | $V_{(BR)CBO}$  | $I_C = 10\mu\text{A}, I_E=0$                                             | 60   |      | V             |
| Collector-emitter breakdown voltage  | $V_{(BR)CEO}$  | $I_C = 1\text{mA}, I_B=0$                                                | 40   |      | V             |
| Emitter-base breakdown voltage       | $V_{(BR)EBO}$  | $I_E = 10\mu\text{A}, I_C=0$                                             | 5    |      | V             |
| Collector cut-off current            | $I_{CBO}$      | $V_{CB} = 30\text{V}, I_E=0$                                             |      | 0.05 | $\mu\text{A}$ |
| Collector cut-off current            | $I_{CEO}$      | $V_{CE} = 30\text{V}, I_B=0$                                             |      | 0.5  | $\mu\text{A}$ |
| Emitter cut-off current              | $I_{EBO}$      | $V_{EB} = 5\text{V}, I_C=0$                                              |      | 0.05 | $\mu\text{A}$ |
| DC current gain                      | $h_{FE(1)}$    | $V_{CE} = 1\text{V}, I_C = 0.1\text{mA}$                                 | 40   |      |               |
|                                      | $h_{FE(2)}$    | $V_{CE} = 1\text{V}, I_C = 1\text{mA}$                                   | 70   |      |               |
|                                      | $h_{FE(3)}$    | $V_{CE} = 1\text{V}, I_C = 10\text{mA}$                                  | 100  | 300  |               |
|                                      | $h_{FE(4)}$    | $V_{CE} = 1\text{V}, I_C = 50\text{mA}$                                  | 60   |      |               |
|                                      | $h_{FE(5)}$    | $V_{CE} = 1\text{V}, I_C = 100\text{mA}$                                 | 30   |      |               |
| Collector-emitter saturation voltage | $V_{CE(sat)1}$ | $I_C=10\text{mA}, I_B = 1\text{mA}$                                      |      | 0.2  | V             |
|                                      | $V_{CE(sat)2}$ | $I_C=50\text{mA}, I_B = 5\text{mA}$                                      |      | 0.3  | V             |
| Base-emitter saturation voltage      | $V_{BE(sat)1}$ | $I_C = 10\text{mA}, I_B = 1\text{mA}$                                    | 0.65 | 0.85 | V             |
|                                      | $V_{BE(sat)2}$ | $I_C = 50\text{mA}, I_B = 5\text{mA}$                                    |      | 0.95 | V             |
| Transition frequency                 | $f_T$          | $V_{CE}=20\text{V}, I_C=20\text{mA}, f=100\text{MHz}$                    | 300  |      | MHz           |
| Noise figure                         | NF             | $V_{CE}=5\text{V}, I_C=0.1\text{mA}, f=1\text{KHz}, R_g=1\text{K}\Omega$ |      | 5    | dB            |
| Output capacitance                   | $C_{ob}$       | $V_{CB}=5\text{V}, I_E=0, f=1\text{MHz}$                                 |      | 4    | pF            |
| Delay time                           | $t_d$          | $V_{CC}=3\text{V}, V_{BE}=0.5\text{V}$                                   |      | 35   | nS            |
| Rise time                            | $t_r$          | $I_C=10\text{mA}, I_{B1}=-I_{B2}=1\text{mA}$                             |      | 35   | nS            |
| Storage time                         | $t_s$          | $V_{CC}=3\text{V}, I_C=10\text{mA}$                                      |      | 200  | nS            |
| Fall time                            | $t_f$          | $I_{B1}=-I_{B2}=1\text{mA}$                                              |      | 50   | nS            |

## MAXIMUM RATINGS( $T_a=25^{\circ}\text{C}$ unless otherwise noted)

| Symbol    | Parameter                     | Value   | Units              |
|-----------|-------------------------------|---------|--------------------|
| $V_{CBO}$ | Collector-Base Voltage        | -40     | V                  |
| $V_{CEO}$ | Collector-Emitter Voltage     | -40     | V                  |
| $V_{EBO}$ | Emitter-Base Voltage          | -5      | V                  |
| $I_C$     | Collector Current -Continuous | -0.2    | A                  |
| $P_C$     | Collector Power Dissipation   | 0.2     | W                  |
| $T_J$     | Junction Temperature          | 150     | $^{\circ}\text{C}$ |
| $T_{stg}$ | Storage Temperature           | -55-150 | $^{\circ}\text{C}$ |

## PNP 3906 ELECTRICAL CHARACTERISTICS ( $T_a=25^{\circ}\text{C}$ unless otherwise specified)

| Parameter                            | Symbol         | Test conditions                                                            | Min   | Typ | Max   | Unit          |
|--------------------------------------|----------------|----------------------------------------------------------------------------|-------|-----|-------|---------------|
| Collector-base breakdown voltage     | $V_{(BR)CBO}$  | $I_C=-10\mu\text{A}, I_E=0$                                                | -40   |     |       | V             |
| Collector-emitter breakdown voltage  | $V_{(BR)CEO}$  | $I_C=-1\text{mA}, I_B=0$                                                   | -40   |     |       | V             |
| Emitter-base breakdown voltage       | $V_{(BR)EBO}$  | $I_E=-10\mu\text{A}, I_C=0$                                                | -5    |     |       | V             |
| Collector cut-off current            | $I_{CBO}$      | $V_{CB}=-30\text{V}, I_E=0$                                                |       |     | -0.05 | $\mu\text{A}$ |
| Emitter cut-off current              | $I_{EBO}$      | $V_{EB}=-5\text{V}, I_C=0$                                                 |       |     | -0.05 | $\mu\text{A}$ |
| DC current gain                      | $h_{FE(1)}$    | $V_{CE}=-1\text{V}, I_C=-0.1\text{mA}$                                     | 60    |     |       |               |
|                                      | $h_{FE(2)}$    | $V_{CE}=-1\text{V}, I_C=-1\text{mA}$                                       | 80    |     |       |               |
|                                      | $h_{FE(3)}$    | $V_{CE}=-1\text{V}, I_C=-10\text{mA}$                                      | 100   |     | 300   |               |
|                                      | $h_{FE(4)}$    | $V_{CE}=-1\text{V}, I_C=-50\text{mA}$                                      | 60    |     |       |               |
|                                      | $h_{FE(5)}$    | $V_{CE}=-1\text{V}, I_C=-100\text{mA}$                                     | 30    |     |       |               |
| Collector-emitter saturation voltage | $V_{CE(sat)1}$ | $I_C=-10\text{mA}, I_B=-1\text{mA}$                                        |       |     | -0.25 | V             |
|                                      | $V_{CE(sat)2}$ | $I_C=-50\text{mA}, I_B=-5\text{mA}$                                        |       |     | -0.4  | V             |
| Base-emitter saturation voltage      | $V_{BE(sat)1}$ | $I_C=-10\text{mA}, I_B=-1\text{mA}$                                        | -0.65 |     | -0.85 | V             |
|                                      | $V_{BE(sat)2}$ | $I_C=-50\text{mA}, I_B=-5\text{mA}$                                        |       |     | -0.95 | V             |
| Transition frequency                 | $f_T$          | $V_{CE}=-20\text{V}, I_C=-10\text{mA}, f=100\text{MHz}$                    | 250   |     |       | MHz           |
| Collector output capacitance         | $C_{ob}$       | $V_{CB}=-5\text{V}, I_E=0, f=1\text{MHz}$                                  |       |     | 4.5   | pF            |
| Noise figure                         | NF             | $V_{CE}=-5\text{V}, I_C=-0.1\text{mA}, f=1\text{KHz}, R_g=1\text{K}\Omega$ |       |     | 4     | dB            |
| Delay time                           | $t_d$          | $V_{CC}=-3\text{V}, V_{BE}=-0.5\text{V}$                                   |       |     | 35    | nS            |
| Rise time                            | $t_r$          | $I_C=-10\text{mA}, I_{B1}=-I_{B2}=-1\text{mA}$                             |       |     | 35    | nS            |
| Storage time                         | $t_s$          | $V_{CC}=-3\text{V}, I_C=-10\text{mA}$                                      |       |     | 225   | nS            |
| Fall time                            | $t_f$          | $I_{B1}=-I_{B2}=-1\text{mA}$                                               |       |     | 75    | nS            |