



## PRODUCT SPECIFICATIONS

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TYPE: IT128/71

CASE OUTLINE: TO-71

### NPN SILICON DUAL DIFFERENTIAL TRANSISTOR

#### ABSOLUTE MAXIMUM RATING:

|                                            |            |                  |                  |
|--------------------------------------------|------------|------------------|------------------|
| Collector to Base                          | $BV_{CBO}$ | 55**             | Vdc              |
| Emitter to Base                            | $BV_{EBO}$ | 7.0              | Vdc              |
| Collector to Emitter                       | $BV_{CEO}$ | 55               | Vdc              |
| Collector Current                          | $I_C$      | 100              | mA dc            |
| Power Dissipation $T_A = 25^\circ\text{C}$ | $P_D$      |                  | Watts            |
| Power Dissipation $T_C = 25^\circ\text{C}$ | $P_D$      | 0.5 (Both Sides) | Watts            |
| Storage Temperature                        | $T_{stg}$  | -65 to +200      | $^\circ\text{C}$ |
| Operating Temperature                      | $T_J$      | -65 to +200      | $^\circ\text{C}$ |
| Lead Temperature From Case                 | $T_L$      |                  | $^\circ\text{C}$ |

#### ELECTRICAL CHARACTERISTICS $T_A @ 25^\circ\text{C}$

| PARAMETERS                             | SYMBOL          | TEST CONDITIONS                                                                           | MIN       | TYP | MAX | UNIT          |
|----------------------------------------|-----------------|-------------------------------------------------------------------------------------------|-----------|-----|-----|---------------|
| Collector to Collector Voltage         | $BV_{CCO}$      |                                                                                           | 70        |     |     | Vdc           |
| Emitter to Base Voltage                | $BV_{EBO}$      | $I_E = 10\mu\text{A}$                                                                     | 7.0       |     |     | Vdc           |
| Collector to Emitter Voltage           | $BV_{CEO(sus)}$ | $I_C = 1.0\text{mA}$                                                                      | 55        |     |     | Vdc           |
| Collector to Collector Voltage         | $BV_{C1C2}$     | $I_C = 1.0\mu\text{A}$                                                                    | 100       |     |     | Vdc           |
| Collector Cutoff Current               | $I_{CBO}$       | $V_{CB} = 45\text{V}$                                                                     |           |     | 0.1 | nA            |
| Collector Cutoff Current               | $I_{CBO}$       | $V_{CB} = 45\text{V}, T_A = 150^\circ\text{C}$                                            |           |     | 0.1 | $\mu\text{A}$ |
| Collector Cutoff Current               | $I_{CEX}$       |                                                                                           |           |     |     | $\mu\text{A}$ |
| Collector Cutoff Current               | $I_{CEX}$       |                                                                                           |           |     |     | $\mu\text{A}$ |
| Emitter Cutoff Current                 | $I_{EBO}$       | $V_{EB} = 5.0\text{V}$                                                                    |           |     | 0.1 | nA            |
| D.C. Current Gain Pulsed*              | $h_{FE}$        | $I_C = 10\mu\text{A}, V_{CE} = 5.0\text{V}$                                               | 100       |     |     | -             |
| D.C. Current Gain Pulsed*              | $h_{FE}$        | $I_C = 1.0\text{mA}, V_{CE} = 5.0\text{V}$                                                | 150       |     |     | -             |
| D.C. Current Gain Pulsed*              | $h_{FE}$        | $I_C = 1.0\text{mA}, V_{CE} = 5.0\text{V}, T_A = -55^\circ\text{C}$                       | 60        |     |     | -             |
| D.C. Current Gain Pulsed*              | $h_{FE}$        | $I_C = 10\text{mA}, V_{CE} = 5.0\text{V}$                                                 | 170       |     |     | -             |
| D.C. Current Gain Pulsed*              | $h_{FE}$        | $I_C = 50\text{mA}, V_{CE} = 5.0\text{V}$                                                 | 75        |     |     | -             |
| Saturation Voltage*                    | $V_{CE(sat)}$   | $I_C = 10\text{mA}, I_B = 1.0\text{mA}$                                                   |           |     | 0.3 | Vdc           |
| Saturation Voltage*                    | $V_{CE(sat)}$   | $I_C = 50\text{mA}, I_B = 5.0\text{mA}$                                                   |           |     | 0.6 | Vdc           |
| Base Emitter Voltage*                  | $V_{BE(sat)}$   |                                                                                           |           |     |     | Vdc           |
| Base Emitter Voltage*                  | $V_{BE(on)}$    | $I_C = 10\text{mA}, V_{CE} = 5.0\text{V}$                                                 |           |     | 0.9 | Vdc           |
| Base Emitter Voltage*                  | $V_{BE(on)}$    | $I_C = 50\text{mA}, V_{CE} = 5.0\text{V}$                                                 |           |     | 1.0 | Vdc           |
| Current Gain at F =                    | $h_{FE}$        |                                                                                           |           |     |     | -             |
| Emitter Transition Capacitance         | $C_{TE}$        |                                                                                           |           |     |     | pF            |
| Collector to Collector Capacitance     | $C_{C1-C2}$     |                                                                                           |           |     |     | pF            |
| Collector to Collector Leakage Current | $I_{C1-C2}$     |                                                                                           |           |     |     | nA            |
| Output Capacitance                     | $C_{ob}$        | $V_{CB} = 20\text{V}$                                                                     |           |     | 3.0 | pF            |
| Frequency Cutoff                       | f & b           |                                                                                           |           |     |     | MHz           |
| Transition Frequency                   | $f_T$           | $I_C = 10\mu\text{A}, V_{CE} = 5.0\text{V}$<br>$I_C = 1.0\text{mA}, V_{CE} = 5.0\text{V}$ | 10<br>220 |     |     | MHz           |

Notes: \*Pulse Width  $\leq 300\mu\text{sec}$  2% Duty Cycle, \*\*  $I_C = 10\mu\text{A}$



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#### SMALL SIGNAL CHARACTERISTICS

|                                                                                                                                | SYMBOL                    | MIN | TYP | MAX | UNITS             |
|--------------------------------------------------------------------------------------------------------------------------------|---------------------------|-----|-----|-----|-------------------|
| Input Impedance                                                                                                                |                           |     |     |     | Ohms              |
| Voltage Feedback Ratio                                                                                                         |                           |     |     |     | X10-4             |
| Base Current Differential<br>$I_C=10\mu A$ , $V_{CE}=5.0V$                                                                     | $ I_{B1} - I_{B2} $       |     |     | 10  | nA                |
| Base Current Differential<br>$I_C = 1.0mA$ , $V_{CE} = 5.0V$                                                                   | $ I_{B1} - I_{B2} $       |     |     | 1.0 | $\mu A$           |
| DC Current Gain Ratio                                                                                                          | $h_{FE1}/h_{FE2}$         |     |     |     |                   |
| Base-Emitter Voltage Differential<br>$I_C=1.0mA$ , $V_{CE}=5.0V$                                                               | $ V_{BE1}-V_{BE2} $       |     |     | 3.0 | mV                |
| Base-Emitter Voltage Differential Change Due to Temp<br>$I_C=1.0mA$ , $V_{CE}=5.0V$<br>$T_A = -55^{\circ}C$ to $+125^{\circ}C$ | $\Delta(V_{BE1}-V_{BE2})$ |     |     | 10  | $\mu V/^{\circ}C$ |

#### SWITCHING CHARACTERISTICS

|               | SYMBOL    | MIN | TYP | MAX | UNITS |
|---------------|-----------|-----|-----|-----|-------|
| Turn-On Time  | $t_{on}$  |     |     |     | ns    |
| Turn-Off Time | $t_{off}$ |     |     |     | ns    |
| Delay Time    | $t_d$     |     |     |     | ns    |
| Rise Time     | $t_r$     |     |     |     | ns    |
| Storage Time  | $t_s$     |     |     |     | ns    |
| Fall Time     | $t_f$     |     |     |     | ns    |

#### FUNCTIONAL TEST

|                                     | SYMBOL | MIN | TYP | MAX | UNITS |
|-------------------------------------|--------|-----|-----|-----|-------|
| Common-Emitter Amplifier Power Gain | GPE    |     |     |     | dB    |
| Power Output                        | Pout   |     |     |     | Watt  |
| Collector Efficiency                | $\eta$ |     |     |     | %     |
| Power Output                        | Pout   |     |     |     | Watt  |