

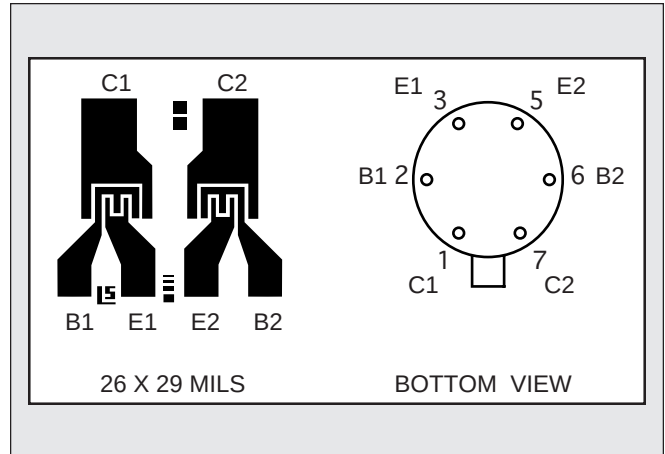
# LINEAR SYSTEMS

*Linear Integrated Systems*

## LS301 LS302 LS303

### HIGH VOLTAGE SUPER-BETA MONOLITHIC DUAL NPN TRANSISTORS

| FEATURES                                                                  |                   |                                            |            |
|---------------------------------------------------------------------------|-------------------|--------------------------------------------|------------|
| VERY HIGH GAIN                                                            |                   | $h_{FE} \geq 2000 @ 1.0\mu A \text{ TYP.}$ |            |
| LOW OUTPUT CAPACITANCE                                                    |                   | $C_{OBO} \leq 2.0pF$                       |            |
| TIGHT $V_{BE}$ MATCHING                                                   |                   | $ V_{BE1} - V_{BE2}  = 0.2mV \text{ TYP.}$ |            |
| HIGH $f_T$                                                                |                   | 100MHz                                     |            |
| ABSOLUTE MAXIMUM RATINGS <b>NOTE 1</b><br>@ 25°C (unless otherwise noted) |                   |                                            |            |
| $I_C$                                                                     | Collector Current | 5mA                                        |            |
| Maximum Temperatures                                                      |                   |                                            |            |
| Storage Temperature                                                       |                   | -65° to +200°C                             |            |
| Operating Junction Temperature                                            |                   | +150°C                                     |            |
| Maximum Power Dissipation                                                 |                   | ONE SIDE                                   | BOTH SIDES |
| Device Dissipation @ Free Air                                             |                   | 250mW                                      | 500mW      |
| Linear Derating Factor                                                    |                   | 2.3mW/°C                                   | 4.3mW/°C   |



#### ELECTRICAL CHARACTERISTICS @ 25°C (unless otherwise noted)

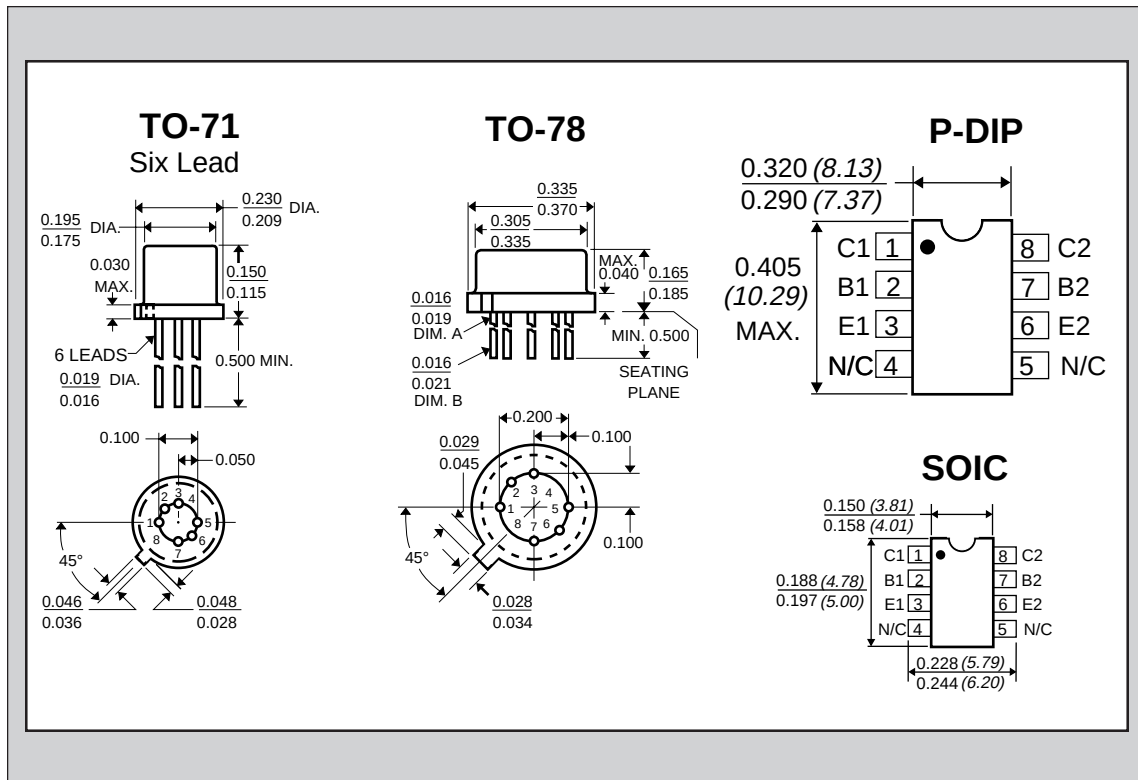
| SYMBOL        | CHARACTERISTICS                        | LS301 | LS302 | LS303 |      | UNITS | CONDITIONS                                                                 |
|---------------|----------------------------------------|-------|-------|-------|------|-------|----------------------------------------------------------------------------|
| $BV_{CBO}$    | Collector to Base Voltage              | 18    | 35    | 10    | MIN. | V     | $I_C = 10\mu A$ $I_E = 0$                                                  |
| $BV_{CEO}$    | Collector to Emitter Voltage           | 18    | 35    | 10    | MIN. | V     | $I_C = 10\mu A$ $I_B = 0$                                                  |
| $BV_{EBO}$    | Emitter-Base Breakdown Voltage         | 6.2   | 6.2   | 6.2   | MIN. | V     | $I_E = 10\mu A$ $I_C = 0$ <b>NOTE 2</b>                                    |
| $BV_{CCO}$    | Collector to Collector Voltage         | 100   | 100   | 100   | MIN. | V     | $I_C = 10\mu A$ $I_E = 0$                                                  |
| $h_{FE}$      | DC Current Gain                        | 2000  | 1000  | 2000  | TYP. |       | $I_C = 1\mu A$ $V_{CE} = 5V$                                               |
| $h_{FE}$      | DC Current Gain                        | 2000  | 1000  | 2000  | MIN. |       | $I_C = 10\mu A$ $V_{CE} = 5V$                                              |
| $h_{FE}$      | DC Current Gain                        | 2000  | 1000  | 2000  | TYP. |       | $I_C = 500\mu A$ $V_{CE} = 5V$                                             |
| $V_{CE(SAT)}$ | Collector Saturation Voltage           | 0.5   | 0.5   | 0.5   | MAX. | V     | $I_C = 1mA$ $I_B = 0.1mA$                                                  |
| $I_{CBO}$     | Collector Cutoff Current               | 100   | 100   | 100   | MAX. | pA    | $I_E = 0$ $V_{CB} = \text{NOTE 3}$                                         |
| $I_{EBO}$     | Emitter Cutoff Current                 | 0.2   | 0.2   | 0.2   | MAX. | pA    | $I_E = 0$ $V_{EB} = 3V$                                                    |
| $C_{OBO}$     | Output Capacitance                     | 2     | 2     | 2     | MAX. | pF    | $I_E = 0$ $V_{CB} = 1V$                                                    |
| $C_{C1C2}$    | Collector to Collector Capacitance     | 2     | 2     | 2     | MAX. | pF    | $V_{CC} = 0$                                                               |
| $I_{C1C2}$    | Collector to Collector Leakage Current | 0.5   | 0.5   | 0.5   | MAX. | nA    | $V_{CC} = \text{NOTE 4}$                                                   |
| $f_T$         | Current Gain Bandwidth Product         | 100   | 100   | 100   | MIN. | MHz   | $I_C = 200\mu A$ $V_{CE} = 5V$                                             |
| NF            | Narrow Band Noise Figure               | 3     | 3     | 3     | MAX. | dB    | $I_C = 10\mu A$ $V_{CE} = 3V$<br>BW = 200Hz $R_G = 10 K\Omega$<br>f = 1KHz |

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# MATCHING CHARACTERISTICS

| SYMBOL                               | CHARACTERISTICS                                              | LS301    | LS302    | LS303      |              | UNITS                                | CONDITIONS                                                               |
|--------------------------------------|--------------------------------------------------------------|----------|----------|------------|--------------|--------------------------------------|--------------------------------------------------------------------------|
| $ V_{BE1} - V_{BE2} $                | Base Emitter Voltage Differential                            | 0.2<br>1 | 0.2<br>1 | 0.2<br>1   | TYP.<br>MAX. | mV<br>mV                             | $I_C = 10 \mu A$<br>$V_{CE} = 5V$                                        |
| $\Delta(V_{BE1} - V_{BE2})/^\circ C$ | Base Emitter Voltage Differential<br>Change with Temperature | 1<br>5   | 1<br>5   | 1<br>5     | TYP.<br>MAX. | $\mu V/^\circ C$<br>$\mu V/^\circ C$ | $I_C = 10 \mu A$<br>$V_{CE} = 5V$<br>$T = -55^\circ C$ to $+125^\circ C$ |
| $ I_{B1} - I_{B2} $                  | Base Current Differential                                    | 0.5<br>1 | 1<br>5   | 0.5<br>1.5 | TYP.<br>MAX. | nA<br>nA                             | $I_C = 10 \mu A$<br>$V_{CE} = 5V$                                        |
| $h_{FE1}/h_{FE2}$                    | DC Current Gain Differential                                 | 5        | 5        | 5          | TYP.         | %                                    | $I_C = 10 \mu A$<br>$V_{CE} = 5V$                                        |



## NOTES:

1. These ratings are limiting values above which the serviceability of any semiconductor may be impaired.
2. The reverse base-to-emitter voltage must never exceed 6.2 volts; the reverse base-to-emitter current must never exceed 10  $\mu A$ mps.
3. For LS301 & LS302:  $V_{CB} = 10V$ ; for LS303:  $V_{CB} = 5V$ .
4. For LS301 & LS302:  $V_{CC} = \pm 80V$ ; for LS303:  $V_{CC} = \pm 20V$ .