GENERAL PURPOSE APPLICATION.
SWITCHING APPLICATION.

FEATURES

- Low Leakage Current
  \[
  I_{CEO} = -50 \text{nA (Max.)}, \quad I_{BE} = -50 \text{nA (Max.)}
  \]
  \[V_{CEO} = -30 \text{V}, \quad V_{BE} = -3 \text{V} \]
- Excellent DC Current Gain Linearity.
- Low Saturation Voltage
  \[
  V_{CE(sat)} = -0.4 \text{V (Max.)} \quad @I_C = -50 \text{mA}, \quad I_B = -5 \text{mA}
  \]
- Low Collector Output Capacitance
  \[
  C_{ob} = 4.5 \text{pF (Max.)} \quad @V_{CE} = 5 \text{V}
  \]
- Complementary to 2N3904.

MAXIMUM RATING (Ta=25°C)

<table>
<thead>
<tr>
<th>CHARACTERISTIC</th>
<th>SYMBOL</th>
<th>RATING</th>
<th>UNIT</th>
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<tbody>
<tr>
<td>Collector-Base Voltage</td>
<td>V_{CBO}</td>
<td>-40</td>
<td>V</td>
</tr>
<tr>
<td>Collector-Emitter Voltage</td>
<td>V_{CEO}</td>
<td>-40</td>
<td>V</td>
</tr>
<tr>
<td>Emitter-Base Voltage</td>
<td>V_{EBO}</td>
<td>-5</td>
<td>V</td>
</tr>
<tr>
<td>Collector Current</td>
<td>I_C</td>
<td>-200</td>
<td>mA</td>
</tr>
<tr>
<td>Base Current</td>
<td>I_B</td>
<td>-50</td>
<td>mA</td>
</tr>
<tr>
<td>Collector Power Dissipation</td>
<td>P_C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ta=25°C</td>
<td>625</td>
<td>mW</td>
<td></td>
</tr>
<tr>
<td>Tc=25°C</td>
<td>1.5</td>
<td>W</td>
<td></td>
</tr>
<tr>
<td>Junction Temperature</td>
<td>T_j</td>
<td>150</td>
<td>°C</td>
</tr>
<tr>
<td>Storage Temperature Range</td>
<td>T_{stg}</td>
<td>-55 – 150</td>
<td>°C</td>
</tr>
</tbody>
</table>
### ELECTRICAL CHARACTERISTICS  \((T_a=25^\circ C)\)

<table>
<thead>
<tr>
<th>CHARACTERISTIC</th>
<th>SYMBOL</th>
<th>TEST CONDITION</th>
<th>MIN.</th>
<th>TYP.</th>
<th>MAX.</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector Cut-off Current</td>
<td>(I_{CEX})</td>
<td>(V_{CE}=-30V,\ V_{EB}=-3V)</td>
<td>-</td>
<td>-</td>
<td>-50</td>
<td>nA</td>
</tr>
<tr>
<td>Base Cut-off Current</td>
<td>(I_{BRL})</td>
<td>(V_{CE}=-30V,\ V_{ER}=-3V)</td>
<td>-</td>
<td>-</td>
<td>-50</td>
<td>nA</td>
</tr>
<tr>
<td>Collector-Base Breakdown Voltage</td>
<td>(V_{B(R)CEO})</td>
<td>(I_C=1 mA,\ I_E=0)</td>
<td>-40</td>
<td>-</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>Collector-Emitter Breakdown Voltage *</td>
<td>(V_{(B)CEO})</td>
<td>(I_C=1 mA,\ I_E=0)</td>
<td>-40</td>
<td>-</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>Emitter-Base Breakdown Voltage</td>
<td>(V_{B(R)EBO})</td>
<td>(I_E=100 mA,\ I_C=0)</td>
<td>-5.0</td>
<td>-</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>DC Current Gain</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>h(_{FE(1)})</td>
<td></td>
<td>(V_{CE}=-1V,\ I_C=0.1 mA)</td>
<td>60</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>h(_{FE(2)})</td>
<td></td>
<td>(V_{CE}=-1V,\ I_C=-1 mA)</td>
<td>80</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>h(_{FE(3)})</td>
<td></td>
<td>(V_{CE}=-1V,\ I_C=-10 mA)</td>
<td>100</td>
<td>-</td>
<td>300</td>
<td></td>
</tr>
<tr>
<td>h(_{FE(4)})</td>
<td></td>
<td>(V_{CE}=-1V,\ I_C=-50 mA)</td>
<td>60</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>h(_{FE(5)})</td>
<td></td>
<td>(V_{CE}=-1V,\ I_C=-100 mA)</td>
<td>30</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Collector-Emitter Saturation Voltage *</td>
<td>(V_{CE(sat)}(1))</td>
<td>(I_C=10 mA,\ I_E=1 mA)</td>
<td>-</td>
<td>-</td>
<td>-0.25</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>(V_{CE(sat)}(2))</td>
<td>(I_C=50 mA,\ I_E=5 mA)</td>
<td>-</td>
<td>-</td>
<td>-0.4</td>
<td>V</td>
</tr>
<tr>
<td>Base-Emitter Saturation Voltage *</td>
<td>(V_{BE(sat)}(1))</td>
<td>(I_C=10 mA,\ I_E=1 mA)</td>
<td>-0.65</td>
<td>-</td>
<td>-0.85</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>(V_{BE(sat)}(2))</td>
<td>(I_C=50 mA,\ I_E=5 mA)</td>
<td>-</td>
<td>-</td>
<td>-0.95</td>
<td>V</td>
</tr>
<tr>
<td>Transition Frequency</td>
<td>(f_T)</td>
<td>(V_{CE}=-20V,\ I_C=10 mA,\ f=100 MHz)</td>
<td>250</td>
<td>-</td>
<td>-</td>
<td>MHz</td>
</tr>
<tr>
<td>Collector Output Capacitance</td>
<td>(C_{ob})</td>
<td>(V_{CE}=-5V,\ I_C=0,\ f=1 MHz)</td>
<td>-</td>
<td>-</td>
<td>4.5</td>
<td>pF</td>
</tr>
<tr>
<td>Input Capacitance</td>
<td>(C_{ib})</td>
<td>(V_{BE}=-0.5 V,\ I_C=0,\ f=1 MHz)</td>
<td>-</td>
<td>-</td>
<td>10</td>
<td>pF</td>
</tr>
<tr>
<td>Input Impedance</td>
<td>(h_{ie})</td>
<td>(V_{CE}=-0.5 V,\ I_C=0,\ f=1 MHz)</td>
<td>2.0</td>
<td>-</td>
<td>12</td>
<td>kΩ</td>
</tr>
<tr>
<td>Voltage Feedback Ratio</td>
<td>(h_{re})</td>
<td>(V_{CE}=-10 V,\ I_C=1 mA,\ f=1 kHz)</td>
<td>1.0</td>
<td>-</td>
<td>10 (\times 10^4)</td>
<td></td>
</tr>
<tr>
<td>Small-Signal Current Gain</td>
<td>(h_{ie})</td>
<td>(V_{CE}=-10 V,\ I_C=1 mA,\ f=1 kHz)</td>
<td>100</td>
<td>-</td>
<td>400</td>
<td></td>
</tr>
<tr>
<td>Collector Output Admittance</td>
<td>(h_{oe})</td>
<td>(V_{CE}=-5 V,\ I_C=0.1 mA,\ R_{g}=1 k\Omega,\ f=10 Hz -15.7 kHz)</td>
<td>3.0</td>
<td>-</td>
<td>60</td>
<td>(\mu F)</td>
</tr>
<tr>
<td>Noise Figure</td>
<td>(NF)</td>
<td>(V_{CE}=-5 V,\ I_C=0.1 mA,\ R_{g}=1 k\Omega,\ f=10 Hz -15.7 kHz)</td>
<td>-</td>
<td>-</td>
<td>4.0</td>
<td>dB</td>
</tr>
</tbody>
</table>

| Switching Time                                |         |                                  |      |      |      |      |
| Delay Time                                    | \(t_d\) | \(V_{in}=10 k\Omega\)           | -    | -    | 35   |      |
| Rise Time                                     | \(t_r\) | \(V_{in}=0.5 V,\ I_{T}=10 nA\) | -    | -    | 35   | nS   |
| Storage Time                                  | \(t_{stg}\) | \(V_{in}=9.1 V,\ I_{T}=10 nA\) | -    | -    | 225  |      |
| Fall Time                                     | \(t_f\) | \(V_{in}=20 k\Omega\)          | -    | -    | 75   |      |

* Pulse Test: Pulse Width \(\leq 300\mu s\), Duty Cycle \(\leq 2\%\).
CAPACITANCE $C_{ob}$, $C_{ib}$ - $V_{EB}$

- $C_{ob}$ - $V_{CB}$, $C_{ib}$ - $V_{EB}$

REVERSE VOLTAGE $V_{CB}$ (V)

$V_{EB}$ (V)

CAPACITANCE $C_{ob}$ (pF)

$C_{ib}$ (pF)

$f=1$MHz

$Ta=25$°C

COLLECTOR POWER DISSIPATION $P_c$ (mW)

AMBIENT TEMPERATURE $Ta$ (°C)

0 100 200 300 400 500 600 700

0 25 50 75 100 125 150 175

$P_c - Ta$

$C_{ob}$ - $V_{CB}$, $C_{ib}$ - $V_{EB}$

$P_c$ - $Ta$

$C_{ob}$ - $V_{CB}$, $C_{ib}$ - $V_{EB}$

$P_c$ - $Ta$

$C_{ob}$ - $V_{CB}$, $C_{ib}$ - $V_{EB}$

$P_c$ - $Ta$