Complementary Silicon Power Transistors

Complementary silicon power transistors are designed for general-purpose switching and amplifier applications.

Features
- DC Current Gain – $h_{FE} = 20−70 @ I_C = 4 \text{ Adc}$
- Collector–Emitter Saturation Voltage – $V_{CE(sat)} = 1.1 \text{ Vdc (Max)} @ I_C = 4 \text{ Adc}$
- Excellent Safe Operating Area
- Pb–Free Packages are Available*

MAXIMUM RATINGS

<table>
<thead>
<tr>
<th>Rating</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector–Emitter Voltage</td>
<td>$V_{CEO}$</td>
<td>60</td>
<td>Vdc</td>
</tr>
<tr>
<td>Collector–Emitter Voltage</td>
<td>$V_{CER}$</td>
<td>70</td>
<td>Vdc</td>
</tr>
<tr>
<td>Collector–Base Voltage</td>
<td>$V_{CB}$</td>
<td>100</td>
<td>Vdc</td>
</tr>
<tr>
<td>Emitter–Base Voltage</td>
<td>$V_{EB}$</td>
<td>7</td>
<td>Vdc</td>
</tr>
<tr>
<td>Collector Current – Continuous</td>
<td>$I_C$</td>
<td>15</td>
<td>Adc</td>
</tr>
<tr>
<td>Base Current</td>
<td>$I_B$</td>
<td>7</td>
<td>Adc</td>
</tr>
<tr>
<td>Total Power Dissipation @ $T_C = 25\degree C$</td>
<td>$P_D$</td>
<td>115</td>
<td>W</td>
</tr>
<tr>
<td>Derate Above 25\degree C</td>
<td></td>
<td>0.657</td>
<td>W/\degree C</td>
</tr>
<tr>
<td>Operating and Storage Junction Temperature Range</td>
<td>$T_J$, $T_{stg}$</td>
<td>-65 to +200</td>
<td>\degree C</td>
</tr>
</tbody>
</table>

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

*For additional information on our Pb–Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.
2N3055(NPN), MJ2955(PNP)

THERMAL CHARACTERISTICS

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Symbol</th>
<th>Max</th>
<th>Unit</th>
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<tbody>
<tr>
<td>Thermal Resistance, Junction–to–Case</td>
<td>Rsjc</td>
<td>1.52</td>
<td>°C/W</td>
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ELECTRICAL CHARACTERISTICS (TC = 25°C unless otherwise noted)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Symbol</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
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</thead>
<tbody>
<tr>
<td>Collector−Emitter Sustaining Voltage (Note 1) (IC = 200 mA, IB = 0)</td>
<td>VCEO(sus)</td>
<td>60</td>
<td>–</td>
<td>Vdc</td>
</tr>
<tr>
<td>Collector−Emitter Sustaining Voltage (IC = 200 mA, RBE = 100 Ω)</td>
<td>VCER(sus)</td>
<td>70</td>
<td>–</td>
<td>Vdc</td>
</tr>
<tr>
<td>Collector Cutoff Current (VCE = 30 V, IB = 0)</td>
<td>ICEO</td>
<td>–</td>
<td>0.7</td>
<td>mA</td>
</tr>
<tr>
<td>Collector Cutoff Current (VCE = 100 V, VBE(off) = 1.5 V)</td>
<td>ICEX</td>
<td>–</td>
<td>1.0</td>
<td>mA</td>
</tr>
<tr>
<td>Collector Cutoff Current (VCE = 100 V, VBE(off) = 1.5 V)</td>
<td>ICEX</td>
<td>–</td>
<td>5.0</td>
<td>mA</td>
</tr>
<tr>
<td>Emitter Cutoff Current (VBE = 7 V, IC = 0)</td>
<td>IEO</td>
<td>–</td>
<td>5.0</td>
<td>mA</td>
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</table>

ON CHARACTERISTICS* (Note 1)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Symbol</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
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</thead>
<tbody>
<tr>
<td>DC Current Gain</td>
<td>hFE</td>
<td>20</td>
<td>70</td>
<td>–</td>
</tr>
<tr>
<td>(IC = 4.0 mA, VCE = 4.0 V)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(IC = 10 mA, VCE = 4.0 V)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collector−Emitter Saturation Voltage (IC = 4.0 mA, IB = 400 mA)</td>
<td>VCE(sat)</td>
<td>–</td>
<td>1.1</td>
<td>Vdc</td>
</tr>
<tr>
<td>(IC = 10 mA, IB = 3.3 mA)</td>
<td></td>
<td></td>
<td>3.0</td>
<td></td>
</tr>
<tr>
<td>Base−Emitter On Voltage (IC = 4.0 mA, VCE = 4.0 V)</td>
<td>VBE(on)</td>
<td>–</td>
<td>1.5</td>
<td>Vdc</td>
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</table>

SECOND BREAKDOWN

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<tr>
<td>Second Breakdown Collector Current with Base Forward Biased (VCE = 40 V, t = 1.0 s, Nonrepetitive)</td>
<td>Is/b</td>
<td>2.87</td>
<td>–</td>
<td>A</td>
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DYNAMIC CHARACTERISTICS

<table>
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<tr>
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<th>Unit</th>
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</thead>
<tbody>
<tr>
<td>Current Gain – Bandwidth Product (IC = 0.5 mA, VCE = 10 V)</td>
<td>fT</td>
<td>2.5</td>
<td>–</td>
<td>MHz</td>
</tr>
<tr>
<td>“Small−Signal Current Gain (IC = 1.0 mA, VCE = 4.0 V)</td>
<td>fHe</td>
<td>15</td>
<td>120</td>
<td>–</td>
</tr>
<tr>
<td>(IC = 1.0 mA, f = 1.0 kHz)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>“Small−Signal Current Gain Cutoff Frequency (IC = 1.0 mA, VCE = 4.0 V)</td>
<td>fHfe</td>
<td>10</td>
<td>–</td>
<td>kHz</td>
</tr>
<tr>
<td>(IC = 1.0 mA, f = 1.0 kHz)</td>
<td></td>
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</table>

*Indicates Within JEDEC Registration. (2N3055)

1. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.

There are two limitations on the power handling ability of a transistor: average junction temperature and second breakdown. Safe operating area curves indicate IC − VCE limits of the transistor that must be observed for reliable operation; i.e., the transistor must not be subjected to greater dissipation than the curves indicate.

The data of Figure 2 is based on TC = 25°C; TJ(pk) is variable depending on power level. Second breakdown pulse limits are valid for duty cycles to 10% but must be derated for temperature according to Figure 1.

Figura 2. Active Region Safe Operating Area
Figure 3. DC Current Gain, 2N3055 (NPN)

Figure 4. DC Current Gain, MJ2955 (PNP)

Figure 5. Collector Saturation Region, 2N3055 (NPN)

Figure 6. Collector Saturation Region, MJ2955 (PNP)

Figure 7. "On" Voltages, 2N3055 (NPN)

Figure 8. "On" Voltages, MJ2955 (PNP)
TO–204 (TO–3)
CASE 1–07
ISSUE Z
DATE 05/18/1988

SCALE 1:1

NOTES:
2. CONTROLLING DIMENSION: INCH.
3. ALL RULES AND NOTES ASSOCIATED WITH REFERENCED TO-204AA OUTLINE SHALL APPLY.

<table>
<thead>
<tr>
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<td></td>
<td>A</td>
<td>1.550</td>
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<td>39.37</td>
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<td>1.050</td>
<td>26.67</td>
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<td></td>
<td>C</td>
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<td>0.335</td>
<td>6.35</td>
<td>8.51</td>
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<td></td>
<td>D</td>
<td>0.038</td>
<td>0.043</td>
<td>0.97</td>
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<tr>
<td></td>
<td>E</td>
<td>0.055</td>
<td>0.070</td>
<td>1.40</td>
<td>1.77</td>
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<tr>
<td></td>
<td>G</td>
<td>0.450</td>
<td>10.92</td>
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<td></td>
<td>H</td>
<td>0.215</td>
<td>BSC</td>
<td>5.46</td>
<td>BSC</td>
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<tr>
<td></td>
<td>K</td>
<td>0.440</td>
<td>11.18</td>
<td>12.19</td>
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<td>0.665</td>
<td>BSC</td>
<td>16.89</td>
<td>BSC</td>
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<td>0.830</td>
<td>21.08</td>
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<td></td>
<td>Q</td>
<td>0.151</td>
<td>0.165</td>
<td>3.84</td>
<td>4.19</td>
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<tr>
<td></td>
<td>U</td>
<td>1.187</td>
<td>BSC</td>
<td>30.15</td>
<td>BSC</td>
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<tr>
<td></td>
<td>V</td>
<td>0.131</td>
<td>0.198</td>
<td>3.33</td>
<td>4.77</td>
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