Standard ICs

Dual high slew rate operational amplifier
BA4560 / BA4560F / BA4560N

The BA4560, BA4560F, and BA4560N are dual operational amplifiers which achieve approximately twice the high output current of the BA4558, as well as featuring a higher slew rate of 4V / μs, a gain band width of 10MHz, and an improved frequency characteristic. The following packages are available: 8-pin DIP (BA4560), 8-pin SOP (BA4560F), and 8-pin SIP (BA4560N).

Applications
- Active filters
- Audio amplifiers
- VCOs
- Other electronic circuits

Features
- 1) Built-in output short-circuit protection circuit.
- 2) Internal phase correction.
- 3) No latch-up.
- 4) Wide range of common-mode modes and differential voltage.
- 5) High gain and low noise.

Block diagram
Standard ICs  BA4560 / BA4560F / BA4560N

- Internal circuit configuration

```
+ IN o
Q1 Q2
Vcc
R2 R3
R1
Q3 Q4
+ IN o
Vee
Q13
R9
D
OUT
```

- Absolute maximum ratings (Ta = 25°C)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Limits</th>
<th>Unit</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply voltage</td>
<td>VCC</td>
<td>±18 ±18 ±18</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Power dissipation</td>
<td>Pd</td>
<td>800* 550* 900*</td>
<td>mW</td>
<td></td>
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<tr>
<td>Differential input voltage</td>
<td>VID</td>
<td>±VCC</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Common-mode input voltage</td>
<td>VI</td>
<td>–VCC ~ VCC</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Operating temperature</td>
<td>Topr</td>
<td>–40 ~ +85</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Storage temperature</td>
<td>Tstg</td>
<td>–55 ~ +125</td>
<td>°C</td>
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</table>

* Refer to the Pd characteristics diagram. The values for the BA4560F are those when it is mounted on a glass epoxy PCB (50mm × 50mm × 1.6mm).

- Electrical characteristics (unless otherwise noted, Ta = 25°C, VCC = +15 V, VEE = -15 V)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
<th>Conditions</th>
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<tbody>
<tr>
<td>Input offset voltage</td>
<td>VIO</td>
<td>0.5</td>
<td>6.0</td>
<td>mV</td>
<td>Rs ≤ 10kΩ</td>
<td></td>
</tr>
<tr>
<td>Input offset current</td>
<td>IIO</td>
<td>5</td>
<td>200</td>
<td>nA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input bias current</td>
<td>IB</td>
<td>50</td>
<td>500</td>
<td>nA</td>
<td></td>
<td></td>
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<tr>
<td>High-amplitude voltage gain</td>
<td>AV</td>
<td>86</td>
<td>100</td>
<td>dB</td>
<td>RL ≥ 2kΩ, VO = ±10V</td>
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</tr>
<tr>
<td>Common-mode input voltage</td>
<td>VCM</td>
<td>±12</td>
<td>±14</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum output voltage 1</td>
<td>VOM1</td>
<td>±12</td>
<td>±14</td>
<td>V</td>
<td>RL ≥ 10kΩ</td>
<td></td>
</tr>
<tr>
<td>Maximum output voltage 2</td>
<td>VOM2</td>
<td>±10</td>
<td>±13</td>
<td>V</td>
<td>RL ≥ 2kΩ</td>
<td></td>
</tr>
<tr>
<td>Common-mode rejection ratio</td>
<td>CMRR</td>
<td>70</td>
<td>90</td>
<td>dB</td>
<td>Rs ≤ 10kΩ</td>
<td></td>
</tr>
<tr>
<td>Power supply voltage rejection ratio</td>
<td>PSRR</td>
<td>30</td>
<td>150</td>
<td>µV / V</td>
<td>Rs ≤ 10kΩ</td>
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</tr>
<tr>
<td>Slew rate</td>
<td>S. R.</td>
<td>4.0</td>
<td>2.2</td>
<td>µV</td>
<td>Av = 1, RL = 2kΩ</td>
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</tr>
<tr>
<td>Input conversion noise voltage</td>
<td>Vn</td>
<td>2.2</td>
<td>2.2</td>
<td>µV</td>
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<td></td>
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<tr>
<td>Gain band width product</td>
<td>GBW</td>
<td>10</td>
<td>10</td>
<td>MHz</td>
<td>f = 10kHz</td>
<td></td>
</tr>
</tbody>
</table>
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Electrical characteristic curves

- Fig. 1: Power dissipation vs. ambient temperature
- Fig. 2: Quiescent current vs. power supply voltage
- Fig. 3: Open loop voltage gain vs. frequency
- Fig. 4: Maximum output voltage vs. frequency
- Fig. 5: Input bias current vs. ambient temperature
- Fig. 6: Input bias current vs. power supply voltage
- Fig. 7: Output response characteristics
- Fig. 8: Common mode input voltage vs. power supply voltage
Operation notes

(1) Handling unused circuits
If there are any circuits which are not being used, we recommend making connections as shown in Figure 9, with the non-inverted input pin connected to the potential within the in-phase input voltage range ($V_{ICM}$).

Fig.9 Unused circuit connections

External dimensions (Units: mm)

<table>
<thead>
<tr>
<th>Dimension</th>
<th>BA4560</th>
<th>BA4560F</th>
<th>BA4560N</th>
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<tbody>
<tr>
<td>DIP8</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>SOP8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SIP8</td>
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