Application Note

Capitalizing on the Design Flexibility of Common Footprint DFN-6 Packages

AN003

At Guerrilla RF, we are constantly adding to our portfolio of 1.5 mm DFN-6 devices. Currently, there are more than 20 amplifier devices in this family - offering a wide variety of gain, NF, linearity and bypass options.

Why do we put so many of our amplifiers into the same package? Simple. It provides our customers with maximum design flexibility. Common packaging means common board layout and common application schematics. The DFN-6 is a leadframe based package known for high reliability, a factory-friendly MSL1 rating and RoHS compliance.

When your specs change - and you know they will - just select a new device from the library which more closely matches the new requirements without needing to re-layout your system board. Now that’s flexibility!

Below is a list of our devices currently using this common package and pinout:

<table>
<thead>
<tr>
<th>Device</th>
<th>Reference V/ma/GHz</th>
<th>Gain (dB)</th>
<th>NF (dB)</th>
<th>OP1dB (dBm)</th>
<th>OIP3 (dBm)</th>
<th>Tuning Range (volts)</th>
<th>VDD Range (Volts)</th>
<th>IDDQ Range (mA)</th>
<th>Comments</th>
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<tr>
<td>GRF2003</td>
<td>5.0/55/5.5</td>
<td>12.0</td>
<td>3.5</td>
<td>15.0</td>
<td>29.0</td>
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<td>2.7 to 5.0</td>
<td>40 to 80</td>
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<td>1.9</td>
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<td>31.0</td>
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<td>2.7 to 5.0</td>
<td>60 to 120</td>
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<td>2.7</td>
<td>23.0</td>
<td>40.0</td>
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<td>2.7 to 5.0</td>
<td>15 to 100</td>
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<td>1.3</td>
<td>22.5</td>
<td>38.5</td>
<td>0.05 to 8.0</td>
<td>2.7 to 5.0</td>
<td>15 to 100</td>
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<td>3.4</td>
<td>24.0</td>
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<td>15 to 80</td>
<td>Bypass Mode</td>
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</tbody>
</table>

* Coming Soon!
The above application schematic can accommodate virtually every device in this group over most frequency bands. New DFN-6 parts are being added to this family every month.

The Guerrilla RF applications engineering team is ready to assist you with custom matching, schematics, data collection and BOM recommendations. Contact us at applications@guerrilla-rf.com with any questions!

Design Examples

The following examples provide a practical demonstration of the design capability offered by this portfolio:

Initial Performance Requirement

**Frequency:** 2500 MHz  
**Gain:** \(\geq 14.0\,\text{dB}\)  
**Max. NF:** \(\leq 1.0\,\text{dB}\)  
**OP1dB:** \(\geq 21.0\,\text{dBm}\)  
**OIP3:** \(\geq 32.0\,\text{dBm}\)  
**Iddq:** \(\leq 80\,\text{mA}\)  
**Vdd:** 5.0 V  
**Bypass Capability:** No

**Initial Solution:**  
**GRF4002**  
**Gain:** 15.0 dB  
**NF:** 0.85 dB  
**OP1dB:** 23.5 dBm  
**OIP3:** 34.0 dBm  
**Iddq:** 70 mA  
**Bypass:** No
For the given initial requirements, GRF4002 has proven to be an excellent solution. But let’s say the system dynamic range requirements change and it is determined that your LNA must offer a low-loss bypass capability which GRF4002 does not provide; the other RF requirements remain unchanged. Luckily, thanks to the breadth of the Guerrilla RF DFN-6 portfolio, a drop-in solution to the new requirement exists and it is called GRF4142.

Revised Solution with Bypass:
GRF4142  
Gain: 14.5 dB  
NF: 0.95 dB  
OP1dB: 22.5 dBm  
OIP3: 33.0 dBm  
Iddq: 70 mA  
Bypass: Yes

The example above showed how a completely new performance capability (bypass) could be accommodated by a single layout using the Guerrilla RF DFN-6 layout and general purpose schematic. The need to revise the layout for a new part/package was avoided.

Following is an example of how this same layout can be used for a different frequency band, with significantly different RF performance targets. For this example, the goal is to find a single, ultra-high gain LNA to reduce a cascaded lineup of two amplifiers — down to a single device for cost and layout purposes.

Performance Requirements:  
Frequency: 1900 MHz  
Gain: >= 26.0 dB Max.  
NF: <= 1.0 dB  
OP1dB: >= 18.0 dBm  
OIP3: >= 30.0 dBm  
Iddq: <= 80 mA  
Vdd: 5.0 V  
Bypass Capability: No

Solution: GRF2133  
Gain: 28.0 dB  
NF: 0.6 dB  
OP1dB: 20.0 dBm  
OIP3: 31.0 dBm  
Iddq: 60 mA

Regardless of your application requirements, the Guerrilla RF applications engineering team is happy to help recommend the optimal solution for you. Contact us at applications@guerrilla-rf.com with any questions!
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Revision History

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<tr>
<th>Revision</th>
<th>Date</th>
<th>Reason for Revision</th>
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<tbody>
<tr>
<td>Initial Release</td>
<td>September 1, 2020</td>
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