Commercial Aerospace Solutions
RF power transistors for higher performance

Building on a legacy of innovation in the RF power transistor market space, Freescale offers a comprehensive portfolio of high power transistors for aerospace applications.

Freescale is the first to offer a robust portfolio to the commercial aerospace market that includes 50V LDMOS devices that range from the very rugged (up to 65:1 VSWR) to the high power output (up to 1.25 kW), as well as 32V LDMOS devices up to 3500 MHz. Freescale’s proven LDMOS technology brings enhancements to aerospace designs with higher gain, lower thermal resistance and higher efficiency for applications ranging from the HF to S-bands.

Freescale’s continued technology advancements provide cost-effective, reliable, field-proven solutions for the commercial aerospace market.

Application Examples
- Weather radar
- Air traffic management
- Distance measuring equipment (DME)
- Long range radio communication
**Freescale Competitive Advantages**

- Highest ruggedness capability in the industry—up to 65:1 VSWR
- Highest efficiency in the industry—up to 80% (Class AB at P1dB)
- High efficiency combined with low thermal resistance:
  - Reduces system cooling requirements
  - Lowers junction temperature, increasing MTTF
- Comprehensive LDMOS solutions from HF to S-band
- 50V LDMOS lineups from HF to L-band
- Cost-effective, over-molded plastic packaging options
- Backed by Freescale’s secure volume manufacturing capability
- Proven reliability, quality and consistency
- Integrated ESD protection with greater negative gate-source voltage range for improved Class C operation
- World-class, global applications and design support
- RoHS compliant
- Field-proven high-voltage LDMOS process

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**230W, 3500 MHz Weather Radar Lineup**

- **37.3 dB of Gain in Three Stages**

  - MMG3014N 316 mW, 9.5 dB
  - MRF7S35015HS 15W, 16 dB
  - MRF7S35120HS (x2) 120W, 12 dB

- **Cost effective**
- **Compact design**
- **LDMOS performance at S-band frequencies**
- **2:1 combining losses (0.2 dB)**

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**330W, 1400 MHz Air Traffic Radar Lineup**

- **61 dB of Gain in Three Stages**

  - MMG3014N 316 mW, 18 dB
  - MRF6V10010N 5W, 25 dB
  - MRF6V14300H 330W, 18 dB

- **Cost effective**
- **Small, low cost, over-molded plastic driver and pre-driver**
- **Compact design**

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**950W, 1030 MHz Air Traffic Radar Lineup**

- **58.8 dB of Gain in Three Stages**

  - MMG3008N 32 mW, 15 dB
  - MRF6V10010N 10W, 24 dB
  - MRF6V12500H/HS (x2) 500W, 20 dB

- **Cost effective**
- **Compact design**
- **Low cost, over-molded plastic driver and pre-driver**
- **2:1 combining losses (0.2 dB)**

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**6.8 kW, 1030 MHz Air Traffic Radar Lineup**

- **68.8 dB of Gain in Three Stages**

  - MMG3014N 316 mW, 19.5 dB
  - MRF6V10010N 10W, 24 dB
  - MRF6V12500H/HS (x2) 500W, 20 dB
  - MRF6V12500H/HS (x8) 1 kW, 20 dB

- **Cost effective**
- **Compact design**
- **Low cost, over-molded plastic driver and pre-driver**
- **8:1 combining losses (0.7 dB)**
Performance Table for UHF/L-Band Aerospace—50 Volt Devices

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Voltage (V)</th>
<th>Operating Frequency (MHz)</th>
<th>Rated Power (W)</th>
<th>Technology</th>
<th>Package</th>
<th>$\theta_{JC}$ °C/W</th>
<th>Typical Gain (dB)</th>
<th>Typical Efficiency (%)</th>
<th>Reference Designs (MHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRF6V2010N/NB</td>
<td>50</td>
<td>10–450</td>
<td>10 CW</td>
<td>VHV6</td>
<td>Over-Molded</td>
<td>1.6(2)</td>
<td>25</td>
<td>69</td>
<td>Pulsed: 1090</td>
</tr>
<tr>
<td>MRF6V10010N</td>
<td>50</td>
<td>960–1400</td>
<td>10(1)</td>
<td>VHV6</td>
<td>Over-Molded</td>
<td>1.6(2)</td>
<td>25</td>
<td>69</td>
<td>Pulsed: 1090</td>
</tr>
<tr>
<td>MRF6V12250H/HS</td>
<td>50</td>
<td>965–1215</td>
<td>275(1)</td>
<td>VHV6</td>
<td>Air Cavity</td>
<td>0.08(3)</td>
<td>20.3</td>
<td>65.5</td>
<td>Pulsed: 965–1215, 1030</td>
</tr>
<tr>
<td>MRF6V12500H/HS</td>
<td>50</td>
<td>960–1215</td>
<td>500(1)</td>
<td>VHV6</td>
<td>Air Cavity</td>
<td>0.13(3)</td>
<td>18</td>
<td>60.5</td>
<td>Pulsed: 1200–1400</td>
</tr>
<tr>
<td>MRF6V12150H/HS</td>
<td>50</td>
<td>965–1215</td>
<td>1000(1)</td>
<td>VHV6</td>
<td>Air Cavity</td>
<td>0.04(3)</td>
<td>19.7</td>
<td>62</td>
<td>Pulsed: 1030</td>
</tr>
<tr>
<td>MRF6V12500H/HS</td>
<td>50</td>
<td>960–1215</td>
<td>1000(1)</td>
<td>VHV6</td>
<td>Air Cavity</td>
<td>0.02(3)</td>
<td>20</td>
<td>56</td>
<td>Pulsed: 785, 1030, 1090</td>
</tr>
</tbody>
</table>

Performance Table for S-Band Aerospace—32 Volt Devices

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Voltage (V)</th>
<th>Operating Frequency (MHz)</th>
<th>Rated Power (W)</th>
<th>Technology</th>
<th>Package</th>
<th>$\theta_{JC}$ °C/W</th>
<th>Typical Gain (dB)</th>
<th>Typical Efficiency (%)</th>
<th>Reference Designs (MHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRF7S35015HS</td>
<td>32</td>
<td>3100–3500</td>
<td>15(1)</td>
<td>HV7</td>
<td>Air Cavity</td>
<td>0.6(2)</td>
<td>16</td>
<td>41</td>
<td>Pulsed: 3500</td>
</tr>
<tr>
<td>MRF7S35120HS</td>
<td>32</td>
<td>3100–3500</td>
<td>120(1)</td>
<td>HV7</td>
<td>Air Cavity</td>
<td>0.11(2)</td>
<td>12</td>
<td>40</td>
<td>Pulsed: 3500</td>
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<tr>
<td>MRF8P29300H/HS*</td>
<td>30</td>
<td>2700–2900</td>
<td>320(1)</td>
<td>HV8</td>
<td>Air Cavity</td>
<td>-</td>
<td>13.3</td>
<td>50.5</td>
<td>Pulsed: 2900</td>
</tr>
</tbody>
</table>

RF Power Aerospace Portfolio

>1 kW

MRF6V12500H/HS
1250W, Ni-1230/S
1.8–600 MHz, 65:1 VSWR

MRF8P29300H/HS
1 kW Pulsed, Ni-1230/S
2700–2900 MHz

>600W

MRF6V12500H/HS
500W, Ni-780/S
960–1215 MHz

500W to 100W

MRF6V14300H/HS
300W, Ni-780/S
1200–1400 MHz

MRF6V4300H/NB
300W CW, TO-270/272-WB4
10–600 MHz

<100W

MRF6V2010N/NB
10W, TO-270-2, TO-272-2
10–450 MHz

MRF6V10010N
10W, PLD-1.5
960–1400 MHz

MRF7S35015HS
15W, Ni-400S-240
3100–3500 MHz

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*Preliminary
(1) Peak power
(2) Refer to the respective part number data sheet for thermal measurement operating conditions.
Industry Leading Packaging
With over 80 million RF power devices delivered in over-molded plastic packaging, Freescale has established a proven track record for reliability. Thermally optimized, these packages demonstrate an industry-leading junction thermal resistance with 0.24°C/W for a single-ended part rated at 300 Watts. These RoHS-compliant packages are also available in both solder reflow and bolt down versions.

Why Freescale?
• RF performance leadership
• Package design
  ○ Freescale JEDEC-registered TO series is the only over-molded plastic package series specifically designed for high power RF applications
  ○ The OMNI series of over-molded packages are designed to be mechanical drop-ins for their air cavity equivalents
  ○ Bolt down, clamp down and solder reflow mounting options
  ○ Multiple mounting configurations
  ○ 225°C TJ
• Manufacturing
  ○ Internal dedicated RF power plastic manufacturing line
  ○ Over 80 million RF power plastic packages shipped with no known package related failures
  ○ Automated high volume assembly and test
  ○ Multiple manufacturing locations
• Materials
  ○ RoHS compliant
• Over-molded plastic
  ○ Highly conductive die attach for better thermal performance
  ○ Package with a larger heatsink contact area for optimum thermal performance
• Conventional ceramic packaging
  ○ Lower thermal resistance flange material
  ○ Higher on-package impedance matching
  ○ Higher power > 1 kW
  ○ Low Au solderable finish

Design Support
For information on design support for commercial aerospace products select Design Support at www.freescale.com/rfaerospace.
• MTTF Calculation Programs
• Application-specific Reference Designs
• RF High Power Models—ADS and AWR Microwave Office®
• RF 50V LDMOS White Paper
• Video introducing Freescale’s new 65:1 VSWR 50V LDMOS device designed for high mismatch applications

Learn More: For current information about Freescale RF solutions, please visit: www.freescale.com/rfpower.