MRF160

The RF MOSFET Line: Broadband Power FET
4W, to 500MHz, 28V

Designed primarily for wideband large-signal output and driver from 30–500 MHz.

N-Channel enhancement mode MOSFET

- Guaranteed 28 V, 500 MHz performance
  - Output power = 4.0 W
  - Gain = 16 dB (min.)
  - Efficiency = 55% (typ.)
- Excellent thermal stability, ideally suited for Class A operation
- Facilitates manual gain control, ALC and modulation techniques
- 100% Tested for load mismatch at all phase angles with 30:1 VSWR
- Low Crss – 0.8 pF Typical at VDS = 28 V

MAXIMUM RATINGS (TJ = 25°C unless otherwise noted)

<table>
<thead>
<tr>
<th>Rating</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain–Gate Voltage</td>
<td>VDSS</td>
<td>65</td>
<td>Vdc</td>
</tr>
<tr>
<td>Drain–Gate Voltage (RGS = 1.0 MΩ)</td>
<td>VDGR</td>
<td>65</td>
<td>Vdc</td>
</tr>
<tr>
<td>Gate–Source Voltage</td>
<td>VGS</td>
<td>± 20</td>
<td>Vdc</td>
</tr>
<tr>
<td>Drain Current–Continuous</td>
<td>ID</td>
<td>1.0</td>
<td>ADG</td>
</tr>
<tr>
<td>Total Device Dissipation @ TC = 25°C Derate Above 25°C</td>
<td>PD</td>
<td>24</td>
<td>0.14 Watt/W°C</td>
</tr>
<tr>
<td>Storage Temperature Range</td>
<td>Tstg</td>
<td>– 65 to +150</td>
<td>°C</td>
</tr>
<tr>
<td>Operating Junction Temperature</td>
<td>TJ</td>
<td>200</td>
<td>°C</td>
</tr>
</tbody>
</table>

THERMAL CHARACTERISTICS

| Thermal Resistance — Junction to Case | RθJC  | 7.2 | °C/W |

NOTE — CAUTION — MOS devices are susceptible to damage from electrostatic charge. Reasonable precautions in handling and packaging MOS devices should be observed.
## ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Symbol</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
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<tbody>
<tr>
<td>OFF CHARACTERISTICS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drain–Source Breakdown Voltage (V_DS = 0 Vdc, V_GS = 0 Vdc, I_D = 1.0 mA)</td>
<td>V_BR(DSS)</td>
<td>65</td>
<td></td>
<td></td>
<td>Vdc</td>
</tr>
<tr>
<td>Zero Gate Voltage Drain Current (V_DS = 28 Vdc, V_GS = 0 V)</td>
<td>I_DSS</td>
<td></td>
<td></td>
<td>0.5</td>
<td>mA</td>
</tr>
<tr>
<td>Gate–Source Leakage Current (V_GS = 20 Vdc, V_DS = 0 Vdc)</td>
<td>I_GSS</td>
<td></td>
<td></td>
<td>1.0</td>
<td>μA</td>
</tr>
<tr>
<td>ON CHARACTERISTICS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gate Threshold Voltage (V_DS = 10 Vdc, I_D = 10 mA)</td>
<td>V_GS(th)</td>
<td>1.5</td>
<td>3.0</td>
<td>4.5</td>
<td>Vdc</td>
</tr>
<tr>
<td>Drain Source On–Voltage (V_DS(on)), V_GS = 10 Vdc, I_D = 500 mA</td>
<td>V_DS(on)</td>
<td></td>
<td>3.8</td>
<td></td>
<td>Vdc</td>
</tr>
<tr>
<td>Forward Transconductance (V_DS = 10 Vdc, I_D = 250 mA)</td>
<td>g_m</td>
<td>150</td>
<td>220</td>
<td></td>
<td>mS</td>
</tr>
<tr>
<td>DYNAMIC CHARACTERISTICS</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Input Capacitance (V_DS = 28 Vdc, V_GS = 0 V, f = 1.0 MHz)</td>
<td>C_iss</td>
<td></td>
<td>6.0</td>
<td></td>
<td>pF</td>
</tr>
<tr>
<td>Output Capacitance (V_DS = 28 V, V_GS = 0 Vdc, f = 1.0 MHz)</td>
<td>C_oss</td>
<td></td>
<td>6.5</td>
<td></td>
<td>pF</td>
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<tr>
<td>Reverse Transfer Capacitance (V_DS = 28 Vdc, V_GS = 0 V, f = 1.0 MHz)</td>
<td>C_tss</td>
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<td>pF</td>
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<td>FUNCTIONAL CHARACTERISTICS</td>
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<tr>
<td>Common Source Power Gain (V_DD = 28 Vdc, P_OUT = 4.0 W, f = 500 MHz, I_DQ = 50 mA)</td>
<td>G_ps</td>
<td>16</td>
<td>18</td>
<td></td>
<td>dB</td>
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<tr>
<td>Drain Efficiency (V_DD = 28 Vdc, P_OUT = 4.0 W, f = 500 MHz, I_DQ = 50 mA)</td>
<td>η</td>
<td>50</td>
<td>55</td>
<td></td>
<td>%</td>
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<td>Electrical Ruggedness (V_DD = 28 Vdc, P_OUT = 4.0 W, f = 500 MHz, I_DQ = 50 mA)</td>
<td>Ψ</td>
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<td></td>
<td>No Degradation in Output Power</td>
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<tr>
<td>Series Equivalent Input Impedance (V_DD = 28 Vdc, P_OUT = 4.0 W, f = 500 MHz, I_DQ = 50 mA)</td>
<td>Z_in</td>
<td></td>
<td>6.8 – j21</td>
<td></td>
<td>Ohms</td>
</tr>
<tr>
<td>Series Equivalent Output Impedance (V_DD = 28 Vdc, P_OUT = 4.0 W, f = 500 MHz, I_DQ = 50 mA)</td>
<td>Z_out</td>
<td></td>
<td>21 – j28</td>
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<td>Ohms</td>
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MRF160

The RF MOSFET Line: Broadband Power FET
4W, to 500MHz, 28V

Rev. V1

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Figure 1. MRF160 500 MHz Test Circuit
Figure 2. MRF160 Broadband Test Fixture
The RF MOSFET Line: Broadband Power FET
4W, to 500MHz, 28V

TYPICAL CHARACTERISTICS

Figure 3. Output Power versus Input Power

Figure 4. Output Power versus Voltage

Figure 5. Output Power versus Gate Voltage

Figure 6. Capacitance versus Drain–Source Voltage

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Figure 7. DC Safe Operating Area
## Table 1. Common Source S-Parameters (V_DDS = 12.5 V, I_D = 120 mA)

<table>
<thead>
<tr>
<th>f MHz</th>
<th>S_{11}</th>
<th>S_{21}</th>
<th>S_{12}</th>
<th>S_{22}</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>0.991</td>
<td>-19</td>
<td>15.80</td>
<td>186</td>
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<tr>
<td>40</td>
<td>0.970</td>
<td>-25</td>
<td>15.50</td>
<td>181</td>
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<td>50</td>
<td>0.959</td>
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<td>15.20</td>
<td>156</td>
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<td>60</td>
<td>0.943</td>
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<td>0.925</td>
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<td>147</td>
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<td>0.912</td>
<td>-48</td>
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<td>143</td>
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<td>141</td>
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<td>13.50</td>
<td>139</td>
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<td>0.872</td>
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<td>11.50</td>
<td>126</td>
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<td>0.814</td>
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<td>0.776</td>
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<td>10.20</td>
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<td>0.734</td>
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<td>109</td>
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<td>0.713</td>
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<td>8.83</td>
<td>107</td>
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<td>8.00</td>
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<td>0.713</td>
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<td>0.693</td>
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<td>6.54</td>
<td>92</td>
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<td>300</td>
<td>0.686</td>
<td>-115</td>
<td>6.36</td>
<td>90</td>
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<tr>
<td>310</td>
<td>0.679</td>
<td>-116</td>
<td>6.12</td>
<td>88</td>
</tr>
<tr>
<td>320</td>
<td>0.679</td>
<td>-117</td>
<td>5.96</td>
<td>87</td>
</tr>
<tr>
<td>330</td>
<td>0.679</td>
<td>-119</td>
<td>5.80</td>
<td>86</td>
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<tr>
<td>340</td>
<td>0.679</td>
<td>-121</td>
<td>5.63</td>
<td>84</td>
</tr>
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<td>350</td>
<td>0.674</td>
<td>-122</td>
<td>5.47</td>
<td>83</td>
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<td>360</td>
<td>0.669</td>
<td>-123</td>
<td>5.33</td>
<td>82</td>
</tr>
<tr>
<td>370</td>
<td>0.667</td>
<td>-124</td>
<td>5.18</td>
<td>80</td>
</tr>
<tr>
<td>380</td>
<td>0.672</td>
<td>-125</td>
<td>5.02</td>
<td>80</td>
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<td>390</td>
<td>0.675</td>
<td>-127</td>
<td>4.96</td>
<td>79</td>
</tr>
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<td>400</td>
<td>0.672</td>
<td>-129</td>
<td>4.89</td>
<td>77</td>
</tr>
<tr>
<td>410</td>
<td>0.668</td>
<td>-130</td>
<td>4.70</td>
<td>75</td>
</tr>
<tr>
<td>420</td>
<td>0.666</td>
<td>-131</td>
<td>4.56</td>
<td>74</td>
</tr>
<tr>
<td>430</td>
<td>0.667</td>
<td>-131</td>
<td>4.48</td>
<td>74</td>
</tr>
</tbody>
</table>
### Table 1. Common Source S–Parameters (VDS = 12.5 V, ID = 120 mA) (continued)

| f MHz | | S11 | | S21 | | S12 | | S22 |
|-------|---|------|---|------|---|------|---|------|---|
|       | | | φ | | | | | | |
| 440   | | 0.671 | | −132 | | 4.99 | | 72 | | 0.066 | | −1 | | 0.651 | | −123 |
| 450   | | 0.670 | | −134 | | 4.29 | | 71 | | 0.068 | | −1 | | 0.663 | | −123 |
| 480   | | 0.662 | | −135 | | 4.15 | | 70 | | 0.067 | | −6 | | 0.677 | | −127 |
| 470   | | 0.663 | | −135 | | 4.05 | | 69 | | 0.065 | | −5 | | 0.664 | | −127 |
| 480   | | 0.666 | | −136 | | 3.95 | | 68 | | 0.064 | | −5 | | 0.663 | | −128 |
| 490   | | 0.670 | | −137 | | 3.88 | | 67 | | 0.064 | | −5 | | 0.663 | | −128 |
| 500   | | 0.670 | | −138 | | 3.81 | | 66 | | 0.063 | | −6 | | 0.670 | | −128 |
| 600   | | 0.693 | | −147 | | 3.06 | | 55 | | 0.053 | | −17 | | 0.689 | | −136 |
| 700   | | 0.708 | | −152 | | 2.61 | | 46 | | 0.044 | | −14 | | 0.723 | | −142 |
| 800   | | 0.731 | | −159 | | 2.22 | | 40 | | 0.037 | | −15 | | 0.733 | | −146 |
| 900   | | 0.724 | | −165 | | 1.93 | | 32 | | 0.037 | | −32 | | 0.760 | | −151 |
| 1000  | | 0.748 | | −169 | | 1.73 | | 28 | | 0.027 | | −6 | | 0.778 | | −153 |

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## Table 2. Common Source S–Parameters (V_Ds = 28 V, I_D = 250 mA)

<p>| f MHz | | S_{11} | | S_{21} | | S_{12} | | S_{22} |
|-------|---|---|---|---|---|---|---|
| 90    | | 0.995 | | −18 | | 15.00 | | 167 | | 0.014 | | 78 | | 0.919 | | −15 |
| 40    | | 0.978 | | −24 | | 14.70 | | 162 | | 0.018 | | 73 | | 0.913 | | −19 |
| 50    | | 0.971 | | −30 | | 14.50 | | 158 | | 0.022 | | 69 | | 0.900 | | −23 |
| 60    | | 0.961 | | −36 | | 14.20 | | 153 | | 0.026 | | 65 | | 0.885 | | −28 |
| 70    | | 0.947 | | −41 | | 13.80 | | 149 | | 0.029 | | 62 | | 0.867 | | −32 |
| 80    | | 0.938 | | −46 | | 13.40 | | 145 | | 0.033 | | 58 | | 0.851 | | −35 |
| 85    | | 0.932 | | −49 | | 13.30 | | 143 | | 0.034 | | 56 | | 0.845 | | −37 |
| 90    | | 0.927 | | −51 | | 13.10 | | 141 | | 0.036 | | 55 | | 0.839 | | −39 |
| 100   | | 0.908 | | −56 | | 12.70 | | 138 | | 0.038 | | 51 | | 0.825 | | −43 |
| 110   | | 0.893 | | −61 | | 12.20 | | 134 | | 0.040 | | 49 | | 0.812 | | −46 |
| 120   | | 0.884 | | −65 | | 11.80 | | 131 | | 0.043 | | 46 | | 0.798 | | −49 |
| 130   | | 0.875 | | −69 | | 11.40 | | 128 | | 0.045 | | 44 | | 0.781 | | −51 |
| 140   | | 0.862 | | −74 | | 11.10 | | 125 | | 0.047 | | 40 | | 0.772 | | −54 |
| 150   | | 0.848 | | −78 | | 10.70 | | 122 | | 0.048 | | 37 | | 0.754 | | −57 |
| 160   | | 0.836 | | −81 | | 10.30 | | 119 | | 0.049 | | 35 | | 0.733 | | −60 |
| 170   | | 0.830 | | −84 | | 9.86 | | 117 | | 0.050 | | 35 | | 0.718 | | −63 |
| 180   | | 0.824 | | −88 | | 9.64 | | 115 | | 0.053 | | 31 | | 0.729 | | −64 |
| 190   | | 0.813 | | −91 | | 9.38 | | 112 | | 0.053 | | 29 | | 0.719 | | −67 |
| 200   | | 0.798 | | −94 | | 9.00 | | 109 | | 0.053 | | 26 | | 0.701 | | −70 |
| 210   | | 0.792 | | −98 | | 8.63 | | 107 | | 0.053 | | 25 | | 0.682 | | −72 |
| 220   | | 0.790 | | −98 | | 8.36 | | 105 | | 0.054 | | 24 | | 0.673 | | −73 |
| 230   | | 0.785 | | −101 | | 8.10 | | 104 | | 0.055 | | 22 | | 0.677 | | −75 |
| 240   | | 0.777 | | −104 | | 7.92 | | 101 | | 0.057 | | 21 | | 0.694 | | −78 |
| 250   | | 0.769 | | −106 | | 7.65 | | 99 | | 0.055 | | 18 | | 0.663 | | −80 |
| 260   | | 0.764 | | −108 | | 7.40 | | 97 | | 0.055 | | 18 | | 0.662 | | −81 |
| 270   | | 0.761 | | −109 | | 7.13 | | 95 | | 0.055 | | 17 | | 0.649 | | −82 |
| 280   | | 0.760 | | −111 | | 6.91 | | 95 | | 0.055 | | 16 | | 0.640 | | −82 |</p>
<table>
<thead>
<tr>
<th>MHz</th>
<th>S&lt;sub&gt;11&lt;/sub&gt;</th>
<th>φ</th>
<th>S&lt;sub&gt;21&lt;/sub&gt;</th>
<th>φ</th>
<th>S&lt;sub&gt;12&lt;/sub&gt;</th>
<th>φ</th>
<th>S&lt;sub&gt;22&lt;/sub&gt;</th>
<th>φ</th>
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<tbody>
<tr>
<td>290</td>
<td>0.757</td>
<td>−113</td>
<td>6.75</td>
<td>93</td>
<td>0.055</td>
<td>14</td>
<td>0.641</td>
<td>−94</td>
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<tr>
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<td>−115</td>
<td>6.59</td>
<td>91</td>
<td>0.056</td>
<td>12</td>
<td>0.645</td>
<td>−86</td>
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<td>89</td>
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<td>9</td>
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<td>11</td>
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<td>−89</td>
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<td>330</td>
<td>0.744</td>
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<td>87</td>
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<td>0.628</td>
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<td>0.055</td>
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<td>0.629</td>
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<td>0.055</td>
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<td>−92</td>
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<tr>
<td>360</td>
<td>0.733</td>
<td>−124</td>
<td>5.55</td>
<td>82</td>
<td>0.054</td>
<td>6</td>
<td>0.631</td>
<td>−94</td>
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<td>370</td>
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The RF MOSFET Line: Broadband Power FET
4W, to 500MHz, 28V

PACKAGE DIMENSIONS

NOTES:
2. CONTROLLING DIMENSION, INCH.
3. SEATING PLANE = GROUND AND IS CONNECTED TO PIN 1 AND 3.

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STYLE:
1. SOURCE
2. GATE
3. SOURCE
4. DRAIN

CASE 249-06
ISSUE H
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