NTLJD3119C

MOSFET – Power, Complementary, WDFN 2X2 mm
20 V/-20 V, 4.6 A/-4.1 A

Features
• Complementary N-Channel and P-Channel MOSFET
• WDFN Package with Exposed Drain Pad for Excellent Thermal Conduction
• Footprint Same as SC–88 Package
• Leading Edge Trench Technology for Low On Resistance
• 1.8 V Gate Threshold Voltage
• Low Profile (< 0.8 mm) for Easy Fit in Thin Environments
• This is a Pb–Free Device

Applications
• Synchronous DC–DC Conversion Circuits
• Load/Power Management of Portable Devices like PDA’s, Cellular Phones and Hard Drives
• Color Display and Camera Flash Regulators

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain–to–Source Voltage</td>
<td>N–Ch</td>
<td>VDSS</td>
<td>20 V</td>
</tr>
<tr>
<td></td>
<td>P–Ch</td>
<td>–20</td>
<td></td>
</tr>
<tr>
<td>Gate–to–Source Voltage</td>
<td>N–Ch</td>
<td>VGS</td>
<td>±8.0 V</td>
</tr>
<tr>
<td></td>
<td>P–Ch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N–Channel Continuous Drain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current (Note 1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steady State</td>
<td></td>
<td>ID</td>
<td>A</td>
</tr>
<tr>
<td>TA = 25°C, t ≤ 5 s</td>
<td></td>
<td>3.8</td>
<td></td>
</tr>
<tr>
<td>TA = 85°C</td>
<td></td>
<td>2.8</td>
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</tr>
<tr>
<td>P–Channel Continuous Drain</td>
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<tr>
<td>Current (Note 1)</td>
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<tr>
<td>Steady State</td>
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<tr>
<td>TA = 25°C, t ≤ 5 s</td>
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<td>TA = 85°C</td>
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<td>–2.4</td>
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<td>Power Dissipation (Note 1)</td>
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<td>Steady State</td>
<td></td>
<td>PD</td>
<td>W</td>
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<td>TA = 25°C, t ≤ 5 s</td>
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<td>Current (Note 2)</td>
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<td>TA = 25°C</td>
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<td>TA = 85°C</td>
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<td>Current (Note 2)</td>
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<tr>
<td>TA = 25°C</td>
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<td>–2.3</td>
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<tr>
<td>TA = 85°C</td>
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<td>–1.6</td>
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<td>Power Dissipation (Note 2)</td>
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<tr>
<td>Steady State</td>
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<td>PD</td>
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<tr>
<td>TA = 25°C</td>
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<td>0.71</td>
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<tr>
<td>Pulsed Drain Current</td>
<td>N–Ch</td>
<td>tP</td>
<td>18 μs</td>
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<td>P–Ch</td>
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<tr>
<td>Operating Junction and Storage</td>
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</tr>
<tr>
<td>Temperature</td>
<td></td>
<td>Tj, TSTG</td>
<td>65 to</td>
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<tr>
<td>(1/8” from case for 10 s)</td>
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<td></td>
<td>150</td>
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<tr>
<td>Lead Temperature for Soldering</td>
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<td>Tl</td>
<td>260  °C</td>
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</table>

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

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May, 2019 – Rev. 5
1. Surface Mounted on FR4 Board using 1 in sq pad size (Cu area = 1.127 in sq [2 oz] including traces).
2. Surface Mounted on FR4 Board using the minimum recommended pad size of 30 mm², 2 oz Cu.
# THERMAL RESISTANCE RATINGS

<table>
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<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Max</th>
<th>Unit</th>
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<tr>
<td><strong>SINGLE OPERATION (SELF-HEATED)</strong></td>
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<tr>
<td>Junction–to–Ambient – Steady State (Note 3)</td>
<td>$R_{JUA}$</td>
<td>83</td>
<td>°C/W</td>
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<tr>
<td>Junction–to–Ambient – Steady State Min Pad (Note 4)</td>
<td>$R_{JUA}$</td>
<td>177</td>
<td>°C/W</td>
</tr>
<tr>
<td>Junction–to–Ambient – $t \leq 5$ s (Note 3)</td>
<td>$R_{JUA}$</td>
<td>54</td>
<td>°C/W</td>
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<tr>
<td><strong>DUAL OPERATION (EQUALLY HEATED)</strong></td>
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<tr>
<td>Junction–to–Ambient – Steady State (Note 3)</td>
<td>$R_{JUA}$</td>
<td>58</td>
<td>°C/W</td>
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<tr>
<td>Junction–to–Ambient – Steady State Min Pad (Note 4)</td>
<td>$R_{JUA}$</td>
<td>133</td>
<td>°C/W</td>
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<tr>
<td>Junction–to–Ambient – $t \leq 5$ s (Note 3)</td>
<td>$R_{JUA}$</td>
<td>40</td>
<td>°C/W</td>
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4. Surface Mounted on FR4 Board using the minimum recommended pad size (30 mm², 2 oz Cu).
### ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>N/P</th>
<th>Test Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
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<td><strong>OFF CHARACTERISTICS</strong></td>
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<tr>
<td>Drain–to–Source Breakdown Voltage</td>
<td>V(BR)DSS</td>
<td>N</td>
<td>V_GS = 0 V</td>
<td>20</td>
<td></td>
<td></td>
<td>V</td>
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<tr>
<td></td>
<td></td>
<td>P</td>
<td>I_D = 250 μA</td>
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<td>-20</td>
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<tr>
<td>Drain–to–Source Breakdown Voltage</td>
<td>V(BR)DSS/T_J</td>
<td>N</td>
<td>V_GS = 0 V, V_DS = 16 V</td>
<td>10.4</td>
<td></td>
<td></td>
<td>mV/°C</td>
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<tr>
<td>Temperature Coefficient</td>
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<td>P</td>
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<td>9.95</td>
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<tr>
<td>Zero Gate Voltage Drain Current</td>
<td>I_DSS</td>
<td>N</td>
<td>V_GS = 0 V, V_DS = 16 V</td>
<td>T_J = 25 °C</td>
<td>1.0</td>
<td></td>
<td>μA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P</td>
<td>V_GS = 0 V, V_DS = 16 V</td>
<td>T_J = 25 °C</td>
<td>-1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>N</td>
<td>V_GS = 0 V, V_DS = 16 V</td>
<td>T_J = 85 °C</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>P</td>
<td>V_GS = 0 V, V_DS = 16 V</td>
<td>T_J = 85 °C</td>
<td>-10</td>
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<tr>
<td>Gate-to-Source Leakage Current</td>
<td>I_GSS</td>
<td>N</td>
<td>V_DS = 0 V, V_GS = ±8.0 V</td>
<td>±100</td>
<td></td>
<td></td>
<td>nA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P</td>
<td>V_DS = 0 V, V_GS = ±8.0 V</td>
<td>±100</td>
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<td><strong>ON CHARACTERISTICS</strong> (Note 5)</td>
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<tr>
<td>Gate Threshold Voltage</td>
<td>V_GS(TH)</td>
<td>N</td>
<td>V_DS = 10 V, I_D = 5.8 A</td>
<td>4.5</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P</td>
<td>V_DS = 5.8 A, I_D = -4.1 A</td>
<td>4.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gate Threshold Temperature Coefficient</td>
<td>V_GS(TH)/T_J</td>
<td>N</td>
<td>V_GS = V_DS, I_D = 2.0 A</td>
<td>-3.0</td>
<td></td>
<td></td>
<td>mV/°C</td>
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<td></td>
<td></td>
<td>P</td>
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<td>2.44</td>
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<tr>
<td>Drain–to–Source On Resistance</td>
<td>R_D(ON)</td>
<td>N</td>
<td>V_GS = 4.5 V, I_D = 3.8 A</td>
<td>37</td>
<td></td>
<td></td>
<td>mΩ</td>
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<td>P</td>
<td>V_GS = 4.5 V, I_D = -4.1 A</td>
<td>37</td>
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<tr>
<td></td>
<td></td>
<td>N</td>
<td>V_GS = 2.5 V, I_D = 2.0 A</td>
<td>75</td>
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<td>P</td>
<td>V_GS = 2.5 V, I_D = -2.0 A</td>
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<tr>
<td></td>
<td></td>
<td>N</td>
<td>V_GS = 1.8 V, I_D = 1.7 A</td>
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<td></td>
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<td></td>
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<td>P</td>
<td>V_GS = 1.8 V, I_D = -1.6 A</td>
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<tr>
<td>Forward Transconductance</td>
<td>g_FS</td>
<td>N</td>
<td>V_DS = 10 V, I_D = 1.7 A</td>
<td>4.2</td>
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<td></td>
<td>S</td>
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<tr>
<td></td>
<td></td>
<td>P</td>
<td>V_DS = -10 V, I_D = -2.0 A</td>
<td>4.2</td>
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<td><strong>CHARGES, CAPACITANCES AND GATE RESISTANCE</strong></td>
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<td>Input Capacitance</td>
<td>C_IGS</td>
<td>N</td>
<td>V_DS = 10 V, I_D = 3.8 A</td>
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<td>pF</td>
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<td>P</td>
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<td>Output Capacitance</td>
<td>C_OSS</td>
<td>N</td>
<td>f = 1.0 MHz, V_GS = 0 V</td>
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<td>pF</td>
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<td>P</td>
<td>V_DS = 10 V, I_D = 10 V</td>
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<td>Reverse Transfer Capacitance</td>
<td>C_RSS</td>
<td>N</td>
<td>V_DS = 10 V, I_D = 10 V</td>
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<td>pF</td>
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<td>P</td>
<td>V_DS = -10 V, I_D = 10 V</td>
<td>56</td>
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<tr>
<td>Total Gate Charge</td>
<td>Q_(G(TOT))</td>
<td>N</td>
<td>V_GS = 4.5 V, V_DS = 10 V, I_D = 3.8 A</td>
<td>3.7</td>
<td></td>
<td></td>
<td>nC</td>
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<tr>
<td></td>
<td></td>
<td>P</td>
<td>V_GS = -4.5 V, V_DS = -10 V, I_D = -2.0 A</td>
<td>5.5</td>
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<tr>
<td>Threshold Gate Charge</td>
<td>Q_(G(TH))</td>
<td>N</td>
<td>V_GS = 4.5 V, V_DS = 10 V, I_D = 3.8 A</td>
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<td>0.7</td>
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<td>Gate-to-Source Charge</td>
<td>Q_GS</td>
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<td>P</td>
<td>V_GS = -4.5 V, V_DS = -10 V, I_D = -2.0 A</td>
<td>1.0</td>
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<td>Gate-to-Drain Charge</td>
<td>Q_GD</td>
<td>N</td>
<td>V_GS = 4.5 V, V_DS = 10 V, I_D = 3.8 A</td>
<td>1.0</td>
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<td>P</td>
<td>V_GS = -4.5 V, V_DS = -10 V, I_D = -2.0 A</td>
<td>1.4</td>
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ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>N/P</th>
<th>Test Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
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<td><strong>SWITCHING CHARACTERISTICS (Note 6)</strong></td>
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<tr>
<td>Turn–On Delay Time</td>
<td>t(ON)</td>
<td>N</td>
<td>V GS = 4.5 V, V DD = 16 V, ID = 1.0 A, R G = 2.0 Ω</td>
<td>3.8</td>
<td></td>
<td></td>
<td>ns</td>
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<tr>
<td>Rise Time</td>
<td>t_r</td>
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<td>Turn–Off Delay Time</td>
<td>t(Off)</td>
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<td>11.1</td>
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<td>Fall Time</td>
<td>t_f</td>
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<td>5.8</td>
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<tr>
<td>Turn–On Delay Time</td>
<td>t(ON)</td>
<td>P</td>
<td>V GS = −4.5 V, V DD = −10 V, ID = −2.0 A, R G = 2.0 Ω</td>
<td>5.2</td>
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<td>Rise Time</td>
<td>t_r</td>
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<td>13.2</td>
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<td>Turn–Off Delay Time</td>
<td>t(Off)</td>
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<td></td>
<td>13.7</td>
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<td></td>
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<tr>
<td>Fall Time</td>
<td>t_f</td>
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<td>19.1</td>
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**DRAIN–SOURCE DIODE CHARACTERISTICS**

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<th>Symbol</th>
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<th>Test Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
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<tbody>
<tr>
<td>Forward Diode Voltage</td>
<td>V_SD</td>
<td>N</td>
<td>V GS = 0 V, T J = 25 °C</td>
<td>0.69</td>
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<td></td>
<td>V</td>
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<td></td>
<td>P</td>
<td>V GS = 0 V, T J = 25 °C</td>
<td>−0.75</td>
<td>−1.0</td>
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<tr>
<td>Reverse Recovery Time</td>
<td>t_RR</td>
<td>N</td>
<td>V GS = 0 V, T J = 125 °C</td>
<td>10.2</td>
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<td></td>
<td>ns</td>
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<tr>
<td></td>
<td></td>
<td>P</td>
<td>V GS = 0 V, T J = 125 °C</td>
<td>16.2</td>
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<td>Charge Time</td>
<td>t_a</td>
<td>N</td>
<td>V GS = 0 V, dI_S / dt = 100 A/μs</td>
<td>6.0</td>
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<td></td>
<td></td>
<td>P</td>
<td>V GS = 0 V, dI_S / dt = 100 A/μs</td>
<td>10.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discharge Time</td>
<td>t_b</td>
<td>N</td>
<td>V GS = 0 V, dI_S / dt = 100 A/μs</td>
<td>0.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>P</td>
<td>V GS = 0 V, dI_S / dt = 100 A/μs</td>
<td>5.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reverse Recovery Charge</td>
<td>Q_RR</td>
<td>N</td>
<td>V GS = 0 V, dI_S / dt = 100 A/μs</td>
<td>3.0</td>
<td></td>
<td></td>
<td>nC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P</td>
<td>V GS = 0 V, dI_S / dt = 100 A/μs</td>
<td>5.7</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%.
6. Switching characteristics are independent of operating junction temperatures.
TYPICAL PERFORMANCE CURVES – N–CHANNEL (T_J = 25°C unless otherwise noted)

**Figure 1. On–Region Characteristics**

**Figure 2. Transfer Characteristics**

**Figure 3. On–Resistance versus Drain Current**

**Figure 4. On–Resistance versus Drain Current and Gate Voltage**

**Figure 5. On–Resistance Variation with Temperature**

**Figure 6. Drain–to–Source Leakage Current versus Voltage**
TYPICAL PERFORMANCE CURVES – N–CHANNEL (T_J = 25°C unless otherwise noted)

Figure 7. Capacitance Variation

Figure 8. Gate–To–Source and Drain–To–Source Voltage versus Total Charge

Figure 9. Resistive Switching Time Variation versus Gate Resistance

Figure 10. Diode Forward Voltage versus Current
TYPICAL PERFORMANCE CURVES – P–CHANNEL (T\text{J} = 25°C unless otherwise noted)

Figure 11. On–Region Characteristics

Figure 12. Transfer Characteristics

Figure 13. On–Resistance versus Drain Current

Figure 14. On–Resistance versus Drain Current and Gate Voltage

Figure 15. On–Resistance Variation with Temperature

Figure 16. Drain–to–Source Leakage Current versus Voltage
TYPICAL PERFORMANCE CURVES – P–CHANNEL (T_J = 25°C unless otherwise noted)

Figure 17. Capacitance Variation

Figure 18. Gate–To–Source and Drain–To–Source Voltage versus Total Charge

Figure 19. Resistive Switching Time Variation versus Gate Resistance

Figure 20. Diode Forward Voltage versus Current

Figure 21. Maximum Rated Forward Biased Safe Operating Area
TYPICAL PERFORMANCE CURVES (T_J = 25°C unless otherwise noted)

Figure 22. Thermal Response
PACKAGE DIMENSIONS

WDFNG 2x2, 0.65P

CASE 506AN

NOTES:
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION A APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 mm FROM THE TERMINAL TIP.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

**PACKAGE INFORMATION**
- **DIMENSIONS:** MILLIMETERS
  - **MIN:**
    - A: 0.70
    - A1: 0.00
    - A3: 0.20
  - **MAX:**
    - b: 0.25
    - D: 2.20
    - E: 2.00
    - E2: 0.92
    - F: 0.95
    - K: 0.25
    - L: 0.05
  - **DIM:**
    - L1: 1.00

**CONSTRUCTIONS**
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