**18A, 200V, 0.180 Ohm, N-Channel Power MOSFETs**

These are N-Channel enhancement mode silicon gate power field effect transistors. They are advanced power MOSFETs designed, tested, and guaranteed to withstand a specified level of energy in the breakdown avalanche mode of operation. All of these power MOSFETs are designed for applications such as switching regulators, switching convertors, motor drivers, relay drivers, and drivers for high power bipolar switching transistors requiring high speed and low gate drive power. These types can be operated directly from integrated circuits.

Formerly developmental type TA17422.

**Features**

- 18A, 200V
- $r_{DS(ON)} = 0.180 \Omega$
- Single Pulse Avalanche Energy Rated
- SOA is Power Dissipation Limited
- Nanosecond Switching Speed
- Linear Transfer Characteristics
- High Input Impedance
- Related Literature
  - TB334 “Guidelines for Soldering Surface Mount Components to PC Boards”

**Ordering Information**

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>PACKAGE</th>
<th>BRAND</th>
</tr>
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<tr>
<td>IRF640</td>
<td>TO-220AB</td>
<td>IRF640</td>
</tr>
<tr>
<td>RF1S640</td>
<td>TO-262AA</td>
<td>RF1S640</td>
</tr>
<tr>
<td>RF1S640SM</td>
<td>TO-263AB</td>
<td>RF1S640</td>
</tr>
</tbody>
</table>

NOTE: When ordering, use the entire part number. Add the suffix 9A to obtain the TO-263AB variant in the tape and reel, i.e., RF1S640SM9A.

**Symbol**

![Symbol Diagram]

**Packaging**

- JEDEC TO-220AB
- JEDEC TO-263AB
- JEDEC TO-262AA
**Absolute Maximum Ratings**  
$T_C = 25^\circ C$, Unless Otherwise Specified

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Test Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain to Source Breakdown Voltage</td>
<td>$V_{DS}$</td>
<td>$I_D = 250\mu A$, $V_{GS} = 0V$, (Figure 10)</td>
<td>200</td>
<td>-</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>Drain to Gate Voltage ($R_{GS} = 20k\Omega$)</td>
<td>$V_{DGR}$</td>
<td>$I_D = 250\mu A$</td>
<td>200</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Continuous Drain Current</td>
<td>$I_D$</td>
<td>$T_C = 100^\circ C$</td>
<td>18</td>
<td>A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulsed Drain Current (Note 3)</td>
<td>$I_{DM}$</td>
<td>$\pm20\mu A$</td>
<td>72</td>
<td>A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gate to Source Voltage</td>
<td>$V_{GS}$</td>
<td>$V_{DS} = 0V$, $T_J = 125^\circ C$</td>
<td>125</td>
<td>W</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Power Dissipation</td>
<td>$P_D$</td>
<td>$T_C = 100^\circ C$</td>
<td>1.0</td>
<td>W/°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single Pulse Avalanche Energy Rating (Note 4)</td>
<td>$E_{AS}$</td>
<td>$V_{DS} = 200V$</td>
<td>580</td>
<td>mJ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Temperature for Soldering</td>
<td>$T_L$, $T_{STG}$</td>
<td>$-55$ to $150^\circ C$</td>
<td>300</td>
<td>°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leads at 0.063in (1.6mm) from Case for 10s</td>
<td>$T_p$</td>
<td>$-5$ to $150^\circ C$</td>
<td>260</td>
<td>°C</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Electrical Specifications**  
$T_C = 25^\circ C$, Unless Otherwise Specified

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Test Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain to Source Breakdown Voltage (Note 1)</td>
<td>$B V_{DSS}$</td>
<td>$V_{DS} = 250\mu A$, $V_{GS} = 0V$</td>
<td>200</td>
<td>-</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>Gate Threshold Voltage</td>
<td>$V_{GSH}(TH)$</td>
<td>$V_{GS} = V_{DS}$, $I_D = 250\mu A$</td>
<td>2</td>
<td>-</td>
<td>4</td>
<td>V</td>
</tr>
<tr>
<td>Zero Gate Voltage Drain Current</td>
<td>$I_{DSS}$</td>
<td>$V_{DS} = 0V$, $I_D = 250\mu A$, $T_J = 125^\circ C$</td>
<td>-</td>
<td>-</td>
<td>25</td>
<td>μA</td>
</tr>
<tr>
<td>On-State Drain Current (Note 1)</td>
<td>$I_{D(ON)}$</td>
<td>$V_{DS} &gt; I_{D(ON)} \times r_{DS(ON)MAX}$</td>
<td>18</td>
<td>-</td>
<td>-</td>
<td>A</td>
</tr>
<tr>
<td>Gate to Source Leakage Current</td>
<td>$I_{GS}$</td>
<td>$V_{GS} = \pm20V$</td>
<td>-</td>
<td>-</td>
<td>$\pm100$</td>
<td>nA</td>
</tr>
<tr>
<td>Drain to Source On Resistance (Note 1)</td>
<td>$R_{DS(ON)}$</td>
<td>$I_D = 10A$, $V_{GS} = 10V$</td>
<td>-</td>
<td>0.14</td>
<td>0.18</td>
<td>Ω</td>
</tr>
<tr>
<td>Forward Transconductance (Note 1)</td>
<td>$g_{fs}$</td>
<td>$V_{DS} = 10V$, $I_D = 11A$</td>
<td>6.7</td>
<td>10</td>
<td>-</td>
<td>S</td>
</tr>
<tr>
<td>Turn-On Delay Time</td>
<td>$t_{d(ON)}$</td>
<td>$V_{DD} = 100V$, $I_D = 18A$, $R_{GS} = 9.1\Omega$, $R_L = 5.4\Omega$</td>
<td>-</td>
<td>13</td>
<td>21</td>
<td>ns</td>
</tr>
<tr>
<td>Rise Time</td>
<td>$t_r$</td>
<td>$V_{DS} = 10V$, $I_D = 11A$</td>
<td>-</td>
<td>50</td>
<td>77</td>
<td>ns</td>
</tr>
<tr>
<td>Turn-Off Delay Time</td>
<td>$t_{d(OFF)}$</td>
<td>$V_{DD} = 100V$, $I_D = 18A$, $R_{GS} = 9.1\Omega$, $R_L = 5.4\Omega$, $V_{GS} = 0V$</td>
<td>-</td>
<td>46</td>
<td>68</td>
<td>ns</td>
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<tr>
<td>Fall Time</td>
<td>$t_f$</td>
<td>$V_{DS} = 25V$, $V_{GS} = 0V$, $f = 1MHz$</td>
<td>-</td>
<td>35</td>
<td>54</td>
<td>ns</td>
</tr>
</tbody>
</table>

**NOTE:**
1. $T_J = 25^\circ C$ to $125^\circ C$. 

**CAUTION:** Stresses above those listed in “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

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Source to Drain Diode Specifications

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>SYMBOL</th>
<th>TEST CONDITIONS</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous Source to Drain Current</td>
<td>$I_{SD}$</td>
<td>Modified MOSFET</td>
<td></td>
<td></td>
<td>18</td>
<td>A</td>
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<tr>
<td>Source to Drain Diode Voltage (Note 2)</td>
<td>$V_{SD}$</td>
<td>$T_J = 25^\circ C$, $I_{SD} = 18A$, $V_{GS} = 0V$, (Figure 13)</td>
<td></td>
<td></td>
<td>2.0</td>
<td>V</td>
</tr>
<tr>
<td>Reverse Recovery Time</td>
<td>$t_{rr}$</td>
<td>$T_J = 25^\circ C$, $I_{SD} = 18A$, $dI_{SD}/dt = 100A/\mu s$</td>
<td>120</td>
<td>240</td>
<td>530</td>
<td>ns</td>
</tr>
<tr>
<td>Reverse Recovery Charge</td>
<td>$Q_{RR}$</td>
<td>$T_J = 25^\circ C$, $I_{SD} = 18A$, $dI_{SD}/dt = 100A/\mu s$</td>
<td>1.3</td>
<td>2.8</td>
<td>5.6</td>
<td>$\mu C$</td>
</tr>
</tbody>
</table>

NOTES:
2. Pulse Test: Pulse width $\leq 300\mu s$, duty cycle $\leq 2\%$.
3. Repetitive Rating: Pulse width limited by maximum junction temperature. See Transient Thermal Impedance curve (Figure 3).
4. $V_D = 50V$, starting $T_J = 25^\circ C$, $L = 3.37mH$, $R_O = 25\Omega$, peak $I_{AS} = 18A$.

Typical Performance Curves  Unless Otherwise Specified

**FIGURE 1. NORMALIZED POWER DISSIPATION vs CASE TEMPERATURE**

**FIGURE 2. MAXIMUM CONTINUOUS DRAIN CURRENT vs CASE TEMPERATURE**

**FIGURE 3. MAXIMUM TRANSIENT THERMAL IMPEDANCE**
Typical Performance Curves  Unless Otherwise Specified  (Continued)

**FIGURE 4. FORWARD BIAS SAFE OPERATING AREA**

**FIGURE 5. OUTPUT CHARACTERISTICS**

**FIGURE 6. SATURATION CHARACTERISTICS**

**FIGURE 7. TRANSFER CHARACTERISTICS**

**FIGURE 8. DRAIN TO SOURCE ON RESISTANCE vs GATE VOLTAGE AND DRAIN CURRENT**

**FIGURE 9. NORMALIZED DRAIN TO SOURCE ON RESISTANCE vs JUNCTION TEMPERATURE**
Typical Performance Curves  Unless Otherwise Specified  (Continued)

**FIGURE 10.** NORMALIZED DRAIN TO SOURCE BREAKDOWN VOLTAGE vs JUNCTION TEMPERATURE

**FIGURE 11.** CAPACITANCE vs DRAIN TO SOURCE VOLTAGE

**FIGURE 12.** TRANSCONDUCTANCE vs DRAIN CURRENT

**FIGURE 13.** SOURCE TO DRAIN DIODE VOLTAGE

**FIGURE 14.** GATE TO SOURCE VOLTAGE vs GATE CHARGE
Test Circuits and Waveforms

Figure 15: Unclamped Energy Test Circuit

Figure 16: Unclamped Energy Waveforms

Figure 17: Switching Time Test Circuit

Figure 18: Resistive Switching Waveforms

Figure 19: Gate Charge Test Circuit

Figure 20: Gate Charge Waveforms
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PRODUCT STATUS DEFINITIONS

Definition of Terms

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<thead>
<tr>
<th>Datasheet Identification</th>
<th>Product Status</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Advance Information</td>
<td>Formative or</td>
<td>This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.</td>
</tr>
<tr>
<td></td>
<td>In Design</td>
<td></td>
</tr>
<tr>
<td>Preliminary</td>
<td>First Production</td>
<td>This datasheet contains preliminary data, and supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.</td>
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