4.5A, 500V, 1.500 Ohm, N-Channel Power MOSFET

This is an N-Channel enhancement mode silicon gate power field effect transistor designed for applications such as switching regulators, switching converters, motor drivers, relay drivers and drivers for high power bipolar switching transistors requiring high speed and low gate drive power. This type can be operated directly from integrated circuits.

Formerly developmental type TA17415.

Features

- 4.5A, 500V
- $r_{\text{DS(ON)}} = 1.500\Omega$
- SOA is Power Dissipation Limited
- Nanosecond Switching Speeds
- Linear Transfer Characteristics
- High Input Impedance
- Majority Carrier Device
- Related Literature
  - TB334 “Guidelines for Soldering Surface Mount Components to PC Boards”

Symbol

Packaging

JEDEC TO-220AB

CAUTION: These devices are sensitive to electrostatic discharge; follow proper IC Handling Procedures.

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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>$I_D = 250 \mu A, V_{GS} = 0 V$</td>
<td>500</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>$I_D = 1 mA$ (Figure 9)</td>
<td>2.1</td>
<td>3</td>
<td>4</td>
<td>V</td>
</tr>
<tr>
<td>Continuous Drain Current</td>
<td>$I_D$</td>
<td>$T_J = 25^\circ C, V_{DS} = 500V, V_{GS} = 0 V$</td>
<td>-</td>
<td>20</td>
<td>250</td>
<td>$\mu A$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$T_J = 125^\circ C, V_{DS} = 500V, V_{GS} = 0 V$</td>
<td>-</td>
<td>100</td>
<td>1000</td>
<td>$\mu A$</td>
</tr>
<tr>
<td>Pulsed Drain Current (Note 3)</td>
<td>$I_{DM}$</td>
<td>$V_{DS} = 0V, V_{GS} = 20V$</td>
<td>-</td>
<td>10</td>
<td>100</td>
<td>nA</td>
</tr>
<tr>
<td>Gate to Source On Resistance (Note 2)</td>
<td>$r_{DS(ON)}$</td>
<td>$V_{CC} = 30V, I_D = 2.6A, V_{GS} = 10V, R_{GS} = 50\Omega, R_L = 10\Omega.$ (Figures 14, 15)</td>
<td>-</td>
<td>30</td>
<td>45</td>
<td>ns</td>
</tr>
<tr>
<td>Turn-On Delay Time</td>
<td>$t_{ON}$</td>
<td>$V_{CC} = 30V, I_D = 2.6A, V_{GS} = 10V, R_{GS} = 50\Omega, R_L = 10\Omega.$ (Figures 14, 15)</td>
<td>-</td>
<td>40</td>
<td>60</td>
<td>ns</td>
</tr>
<tr>
<td>Rise Time</td>
<td>$t_r$</td>
<td>$V_{DS} = 25V, V_{GS} = 0V, f = 1MHz$ (Figure 10)</td>
<td>-</td>
<td>50</td>
<td>65</td>
<td>ns</td>
</tr>
<tr>
<td>Thermal Resistance Junction to Case</td>
<td>$R_{thJC}$</td>
<td>$T_J = 25^\circ C$</td>
<td>-</td>
<td>1500</td>
<td>2000</td>
<td>pF</td>
</tr>
<tr>
<td>Thermal Resistance Junction to Ambient</td>
<td>$R_{thJA}$</td>
<td>$T_J = 25^\circ C$</td>
<td>-</td>
<td>110</td>
<td>170</td>
<td>pF</td>
</tr>
<tr>
<td>Reverse Transfer Capacitance</td>
<td>$C_{RSS}$</td>
<td>$V_{GS} = 0V, f = 1MHz$ (Figure 10)</td>
<td>-</td>
<td>40</td>
<td>70</td>
<td>pF</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Parameter</th>
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</tr>
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<tr>
<td>Drain to Source On Resistance (Note 2)</td>
<td>$I_{ON}$</td>
<td>$V_{CC} = 30V, I_D = 2.6A, V_{GS} = 10V, R_{GS} = 50\Omega, R_L = 10\Omega.$ (Figures 14, 15)</td>
<td>-</td>
<td>30</td>
<td>45</td>
<td>ns</td>
</tr>
<tr>
<td>Rise Time</td>
<td>$t_r$</td>
<td>$V_{DS} = 25V, V_{GS} = 0V, f = 1MHz$ (Figure 10)</td>
<td>-</td>
<td>50</td>
<td>65</td>
<td>ns</td>
</tr>
<tr>
<td>Turn-Off Delay Time</td>
<td>$t_{OFF}$</td>
<td>$V_{GS} = 0V, f = 1MHz$ (Figure 10)</td>
<td>-</td>
<td>110</td>
<td>140</td>
<td>ns</td>
</tr>
<tr>
<td>Source to Drain Diode Voltage</td>
<td>$V_{SD}$</td>
<td>$T_J = 25^\circ C, I_D = 9A, V_{GS} = 0 V$</td>
<td>-</td>
<td>1.1</td>
<td>1.5</td>
<td>$\Omega$</td>
</tr>
<tr>
<td>Reverse Recovery Time</td>
<td>$t_{rr}$</td>
<td>$V_{R} = 100V$</td>
<td>-</td>
<td>1200</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>Reverse Recovery Charge</td>
<td>$Q_{RR}$</td>
<td>$V_{R} = 100V$</td>
<td>-</td>
<td>6</td>
<td>-</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).
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

FIGURE 4. FORWARD BIAS SAFE OPERATING AREA

FIGURE 5. OUTPUT CHARACTERISTICS
Typical Performance Curves  Unless Otherwise Specified  (Continued)

**FIGURE 6. TRANSFER CHARACTERISTICS**

- Pulse duration = 80µs
- $V_{DS} = 25V$
- $T_J = 25^\circ C$

**FIGURE 7. DRAIN TO SOURCE ON RESISTANCE vs GATE VOLTAGE AND DRAIN CURRENT**

- Pulse duration = 80µs
- $V_{GS} = 5V, 5.5V, 6V, 6.5V$
- $V_{GS} = 7V, 7.5V, 8V, 10V, 20V$

**FIGURE 8. DRAIN TO SOURCE ON RESISTANCE vs JUNCTION TEMPERATURE**

- Pulse duration = 80µs
- $ID = 2.5A$
- $V_{GS} = 10V$

**FIGURE 9. GATE THRESHOLD VOLTAGE vs JUNCTION TEMPERATURE**

- Pulse duration = 80µs
- $V_{DS} = V_{GS}$, $ID = 1mA$

**FIGURE 10. CAPACITANCE vs DRAIN TO SOURCE VOLTAGE**

- $V_{GS} = 0, f = 1MHz$
- $C_{ISS} \approx C_{DS} + C_{GD}$
- $C_{OSS} = C_{DS} + C_{GD}$

**FIGURE 11. TRANSCONDUCTANCE vs DRAIN CURRENT**

- Pulse duration = 80µs
- $V_{DS} = 25V$
- $T_J = 25^\circ C$
Typical Performance Curves  Unless Otherwise Specified  (Continued)

Test Circuits and Waveforms

FIGURE 12. SOURCE TO DRAIN DIODE VOLTAGE

FIGURE 13. GATE TO SOURCE VOLTAGE vs GATE CHARGE

FIGURE 14. SWITCHING TIME TEST CIRCUIT

FIGURE 15. RESISTIVE SWITCHING WAVEFORMS

FIGURE 16. GATE CHARGE TEST CIRCUIT

FIGURE 17. GATE CHARGE WAVEFORMS