

**FAIRCHILD**

A Schlumberger Company

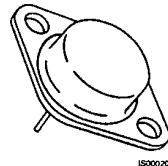
**IRF120-123/IRF520-523** T-39-11**MTP10N08/10N10****N-Channel Power MOSFETs,  
11 A, 60-100 V**

Power And Discrete Division

**Description**

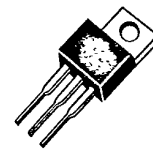
These devices are n-channel, enhancement mode, power MOSFETs designed especially for high speed applications, such as switching power supplies, converters, AC and DC motor controls, relay and solenoid drivers and other pulse circuits.

- Low  $R_{DS(on)}$
- $V_{GS}$  Rated at  $\pm 20$  V
- Silicon Gate for Fast Switching Speeds
- $I_{DSS}$ ,  $V_{DS(on)}$ , Specified at Elevated Temperature
- Rugged
- Low Drive Requirements
- Ease of Paralleling

**TO-204AA**

IS00020F

IRF120  
IRF121  
IRF122  
IRF123

**TO-220AB**

IS00010F

IRF520  
IRF521  
IRF522  
IRF523  
MTP10N08  
MTP10N10

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**Product Summary**

| Part Number | $V_{DSS}$ | $R_{DS(on)}$  | $I_D$ at<br>$T_C = 25^\circ\text{C}$ | $I_D$ at<br>$T_C = 100^\circ\text{C}$ | Case Style |
|-------------|-----------|---------------|--------------------------------------|---------------------------------------|------------|
| IRF120      | 100 V     | $0.30 \Omega$ | 8.0 A                                | 5.0 A                                 | TO-204AA   |
| IRF121      | 60 V      | $0.30 \Omega$ | 8.0 A                                | 5.0 A                                 |            |
| IRF122      | 100 V     | $0.40 \Omega$ | 7.0 A                                | 4.0 A                                 |            |
| IRF123      | 60 V      | $0.40 \Omega$ | 7.0 A                                | 4.0 A                                 |            |
| IRF520      | 100 V     | $0.30 \Omega$ | 8.0 A                                | 5.0 A                                 | TO-220AB   |
| IRF521      | 60 V      | $0.30 \Omega$ | 8.0 A                                | 5.0 A                                 |            |
| IRF522      | 100 V     | $0.40 \Omega$ | 7.0 A                                | 4.0 A                                 |            |
| IRF523      | 60 V      | $0.40 \Omega$ | 7.0 A                                | 4.0 A                                 |            |
| MTP10N08    | 80 V      | $0.33 \Omega$ | 10 A                                 | 6.4 A                                 |            |
| MTP10N10    | 100 V     | $0.33 \Omega$ | 10 A                                 | 6.4 A                                 |            |

**Notes**

For information concerning connection diagram and package outline, refer to Section 7.

**IRF120-123/IRF520-523**  
**MTP10N08/10N10**

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**Maximum Ratings**

| Symbol                            | Characteristic                                                                | Rating<br>IRF120/122<br>IRF520/522<br>MTP10N10 | Rating<br>MTP10N08 | Rating<br>IRF122/123<br>IRF522/523 | Unit |
|-----------------------------------|-------------------------------------------------------------------------------|------------------------------------------------|--------------------|------------------------------------|------|
| V <sub>DSS</sub>                  | Drain to Source Voltage <sup>1</sup>                                          | 100                                            | 80                 | 60                                 | V    |
| V <sub>DGR</sub>                  | Drain to Gate Voltage <sup>1</sup><br>R <sub>GS</sub> = 20 k $\Omega$         | 100                                            | 80                 | 60                                 | V    |
| V <sub>GS</sub>                   | Gate to Source Voltage                                                        | $\pm 20$                                       | $\pm 20$           | $\pm 20$                           | V    |
| T <sub>J</sub> , T <sub>stg</sub> | Operating Junction and<br>Storage Temperatures                                | -55 to +150                                    | -55 to +150        | -55 to +150                        | °C   |
| T <sub>L</sub>                    | Maximum Lead Temperature<br>for Soldering Purposes,<br>1/8" From Case for 5 s | 275                                            | 275                | 275                                | °C   |

**Maximum Thermal Characteristics**

|                                    |                                                     | IRF120-123/IRF520-523 | MTP10N08/10 |      |
|------------------------------------|-----------------------------------------------------|-----------------------|-------------|------|
| R <sub><math>\theta</math>JC</sub> | Thermal Resistance,<br>Junction to Case             | 3.12                  | 1.67        | °C/W |
| R <sub><math>\theta</math>JA</sub> | Thermal Resistance,<br>Junction to Ambient          | 30/80                 | 80          | °C/W |
| P <sub>D</sub>                     | Total Power Dissipation<br>at T <sub>C</sub> = 25°C | 40                    | 75          | W    |
| I <sub>DM</sub>                    | Pulsed Drain Current <sup>2</sup>                   | 20                    | 32          | A    |

**Electrical Characteristics** (T<sub>C</sub> = 25°C unless otherwise noted)

| Symbol                     | Characteristic                                                                 | Min | Max                    | Unit    | Test Conditions                                                                                   |
|----------------------------|--------------------------------------------------------------------------------|-----|------------------------|---------|---------------------------------------------------------------------------------------------------|
| <b>Off Characteristics</b> |                                                                                |     |                        |         |                                                                                                   |
| V <sub>(BR)DSS</sub>       | Drain Source Breakdown Voltage <sup>1</sup><br>IRF120/122/520/522/<br>MTP10N10 | 100 |                        | V       | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 $\mu$ A                                               |
|                            | MTP10N08                                                                       | 80  |                        |         |                                                                                                   |
|                            | IRF121/123/521/523                                                             | 60  |                        |         |                                                                                                   |
| I <sub>DSS</sub>           | Zero Gate Voltage Drain Current                                                |     | 250                    | $\mu$ A | V <sub>DS</sub> = Rated V <sub>DSS</sub> , V <sub>GS</sub> = 0 V                                  |
|                            |                                                                                |     | 1000                   | $\mu$ A | V <sub>DS</sub> = 0.8 x Rated V <sub>DSS</sub> ,<br>V <sub>GS</sub> = 0 V, T <sub>C</sub> = 125°C |
| I <sub>GSS</sub>           | Gate-Body Leakage Current<br>IRF120-123<br>IRF520-523/MTP10N08/10              |     | $\pm 100$<br>$\pm 500$ | nA      | V <sub>GS</sub> = $\pm 20$ V, V <sub>DS</sub> = 0 V                                               |

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**MTP10N08/10N10**

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**Electrical Characteristics (Cont.)** ( $T_C = 25^\circ\text{C}$  unless otherwise noted)

| Symbol                    | Characteristic                                          | Min | Max  | Unit           | Test Conditions                                                              |
|---------------------------|---------------------------------------------------------|-----|------|----------------|------------------------------------------------------------------------------|
| <b>On Characteristics</b> |                                                         |     |      |                |                                                                              |
| $V_{GS(th)}$              | Gate Threshold Voltage                                  |     |      | V              |                                                                              |
|                           | IRF120-123/IRF520-523                                   | 2.0 | 4.0  |                | $I_D = 250\ \mu\text{A}$ , $V_{DS} = V_{GS}$                                 |
|                           | MTP10N08/10N10                                          | 2.0 | 4.5  |                | $I_D = 1\ \text{mA}$ , $V_{DS} = V_{GS}$                                     |
| $R_{DS(on)}$              | Static Drain-Source On-Resistance <sup>2</sup>          |     |      | $\Omega$       | $V_{GS} = 10\ \text{V}$                                                      |
|                           | IRF120/121/520/521                                      |     | 0.30 |                | $I_D = 4.0\ \text{A}$                                                        |
|                           | MTP10N08/10N10                                          |     | 0.33 |                | $I_D = 5.0\ \text{A}$                                                        |
|                           | IRF122/123/522/523                                      |     | 0.40 |                | $I_D = 4.0\ \text{A}$                                                        |
| $V_{DS(on)}$              | Drain-Source On-Voltage <sup>2</sup><br>MTP 10N08/10N10 |     | 4.0  | V              | $V_{GS} = 10\ \text{V}$ ; $I_D = 10.0\ \text{A}$                             |
|                           |                                                         |     | 3.3  | V              | $V_{GS} = 10\ \text{V}$ , $I_D = 5.0\ \text{A}$<br>$T_C = 100^\circ\text{C}$ |
| $g_{fs}$                  | Forward Transconductance                                | 1.5 |      | S ( $\Omega$ ) | $V_{DS} = 10\ \text{V}$ , $I_D = 4.0\ \text{A}$                              |

**Dynamic Characteristics**

|           |                              |  |     |    |                                                                           |
|-----------|------------------------------|--|-----|----|---------------------------------------------------------------------------|
| $C_{iss}$ | Input Capacitance            |  | 600 | pF | $V_{DS} = 25\ \text{V}$ , $V_{GS} = 0\ \text{V}$<br>$f = 1.0\ \text{MHz}$ |
| $C_{oss}$ | Output Capacitance           |  | 400 | pF |                                                                           |
| $C_{rss}$ | Reverse Transfer Capacitance |  | 100 | pF |                                                                           |

**Switching Characteristics** ( $T_C = 25^\circ\text{C}$ , Figures 1, 2)<sup>3</sup>

|              |                     |  |     |    |                                                                                                                              |
|--------------|---------------------|--|-----|----|------------------------------------------------------------------------------------------------------------------------------|
| $t_{d(on)}$  | Turn-On Delay Time  |  | 40  | ns | $V_{DD} = 50\ \text{V}$ , $I_D = 4.0\ \text{A}$<br>$V_{GS} = 10\ \text{V}$ , $R_{GEN} = 50\ \Omega$<br>$R_{GS} = 50\ \Omega$ |
| $t_r$        | Rise Time           |  | 70  | ns |                                                                                                                              |
| $t_{d(off)}$ | Turn-Off Delay Time |  | 100 | ns |                                                                                                                              |
| $t_f$        | Fall Time           |  | 70  | ns |                                                                                                                              |
| $Q_g$        | Total Gate Charge   |  | 15  | nC | $V_{GS} = 10\ \text{V}$ , $I_D = 10\ \text{A}$<br>$V_{DD} = 50\ \text{V}$                                                    |

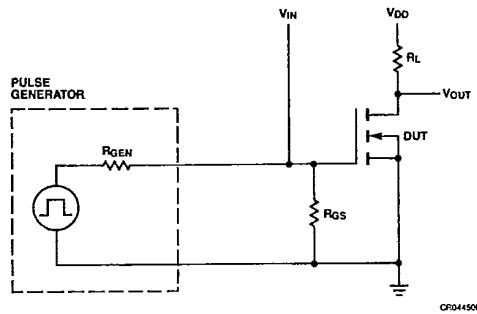
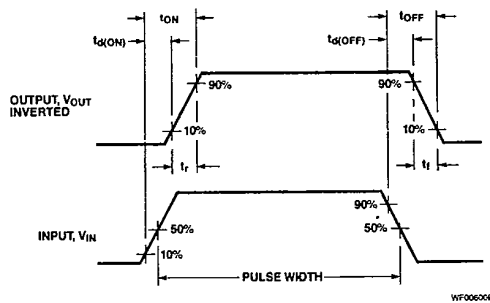
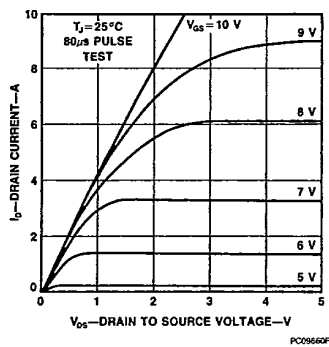
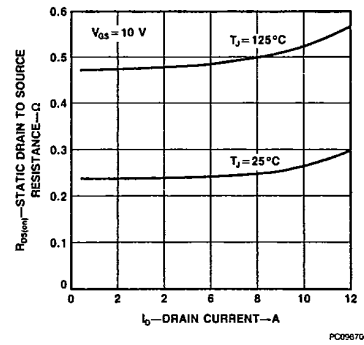
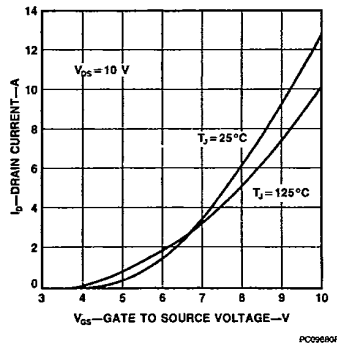
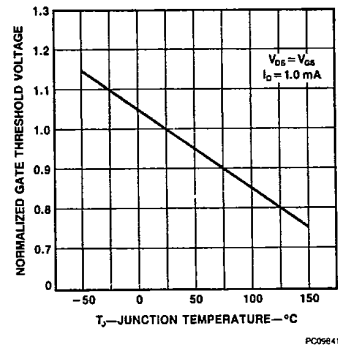
| Symbol                                    | Characteristic        | Typ | Max | Unit | Test Conditions                                              |
|-------------------------------------------|-----------------------|-----|-----|------|--------------------------------------------------------------|
| <b>Source-Drain Diode Characteristics</b> |                       |     |     |      |                                                              |
| $V_{SD}$                                  | Diode Forward Voltage |     |     | V    |                                                              |
|                                           | IRF120/121/520/521    |     | 2.5 | V    | $I_S = 8.0\ \text{A}$ ; $V_{GS} = 0\ \text{V}$               |
|                                           | IRF122/123/522/523    |     | 2.3 | V    | $I_S = 7.0\ \text{A}$ ; $V_{GS} = 0\ \text{V}$               |
| $t_{rr}$                                  | Reverse Recovery Time | 280 |     | ns   | $I_S = 4.0\ \text{A}$ ; $di_S/dt = 25\ \text{A}/\mu\text{S}$ |

**Notes**

- $T_J = +25^\circ\text{C}$  to  $+150^\circ\text{C}$
- Pulse width limited by  $T_J$
- Switching time measurements performed on LEM TR-58 test equipment.

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**Typical Electrical Characteristics****Figure 1 Switching Test Circuit****Figure 2 Switching Waveforms****Typical Performance Curves****Figure 3 Output Characteristics****Figure 4 Static Drain to Source Resistance vs Drain Current****Figure 5 Transfer Characteristics****Figure 6 Temperature Variation of Gate to Source Threshold Voltage**

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## Typical Performance Curves (Cont.)

Figure 7 Capacitance vs Drain to Source Voltage

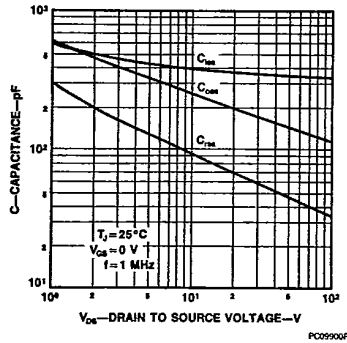


Figure 8 Gate to Source Voltage vs Total Gate Charge

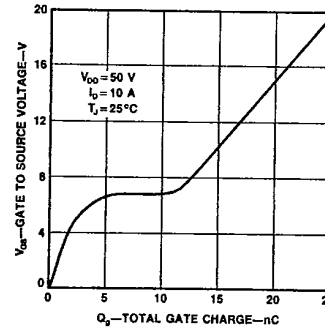


Figure 9 Forward Biased Safe Operating Area for IRF120-123 And IRF520-523

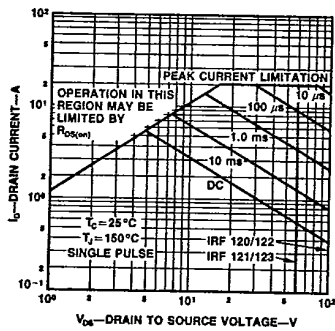


Figure 11 Forward Biased Safe Operating Area for MTP10N08/10N10

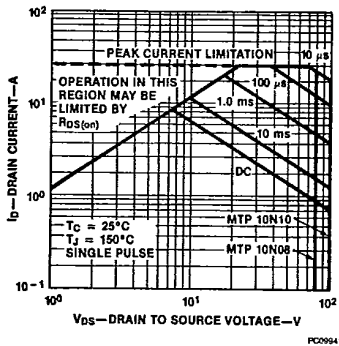


Figure 10 Transient Thermal Resistance vs Time for IRF120-123 And IRF520-523

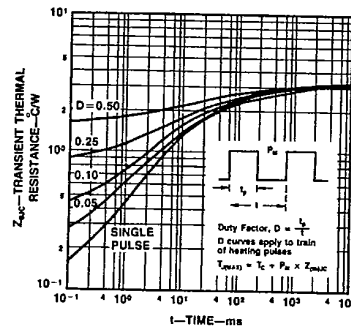


Figure 12 Transient Thermal Resistance vs Time for MTP10N08/10N10

