

**FAIRCHILD**

A Schlumberger Company

# IRF430-433/IRF830-833

## MTM/MTP4N45/4N50

### N-Channel Power MOSFETs,

#### 4.5 A, 450 V/500 V

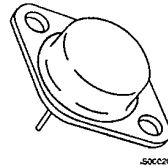
Power And Discrete Division

T-39-11

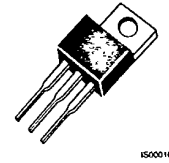
**Description**

These devices are n-channel, enhancement mode, power MOSFETs designed especially for high voltage, high speed applications, such as off-line switching power supplies, UPS, AC and DC motor controls, relay and solenoid drivers.

- $V_{GS}$  Rated at  $\pm 20$  V
- Silicon Gate for Fast Switching Speeds
- $I_{DSS}$ ,  $V_{DS(on)}$ , SOA and  $V_{GS(th)}$  Specified at Elevated Temperature
- Rugged

**TO-204AA**

IRF430  
IRF431  
IRF432  
IRF433  
MTM4N45  
MTM4N50

**TO-220AB**

IRF830  
IRF831  
IRF832  
IRF833  
MTP4N45  
MTP4N50

**Maximum Ratings**

| Symbol         | Characteristic                                                                | Rating<br>IRF430/432<br>IRF830/832<br>MTM/MTP4N50 | Rating<br>IRF431/433<br>IRF831/833<br>MTM/MTP4N45 | Unit               |
|----------------|-------------------------------------------------------------------------------|---------------------------------------------------|---------------------------------------------------|--------------------|
| $V_{DSS}$      | Drain to Source Voltage                                                       | 500                                               | 450                                               | V                  |
| $V_{DGR}$      | Drain to Gate Voltage<br>$R_{GS} = 20 \text{ k}\Omega$                        | 500                                               | 450                                               | V                  |
| $V_{GS}$       | Gate to Source Voltage                                                        | $\pm 20$                                          | $\pm 20$                                          | V                  |
| $T_J, T_{stg}$ | Operating Junction and<br>Storage Temperature                                 | -55 to +150                                       | -55 to +150                                       | $^{\circ}\text{C}$ |
| $T_L$          | Maximum Lead Temperature<br>for Soldering Purposes,<br>1/8" From Case for 5 s | 275                                               | 275                                               | $^{\circ}\text{C}$ |

**Maximum On-State Characteristics**

|              |                                         | IRF430/431<br>IRF830/831 | IRF432/433<br>IRF832/833 | MTM/MTP4N45<br>MTM/MTP4N45 |          |
|--------------|-----------------------------------------|--------------------------|--------------------------|----------------------------|----------|
| $R_{DS(on)}$ | Static Drain-to-Source<br>On Resistance | 1.5                      | 2.0                      | 1.5                        | $\Omega$ |
| $I_D$        | Drain Current<br>Continuous<br>Pulsed   | 4.5<br>18                | 4.0<br>16                | 4.0<br>10                  | A        |

**Maximum Thermal Characteristics**

|                 |                                                          |      |      |      |                             |
|-----------------|----------------------------------------------------------|------|------|------|-----------------------------|
| $R_{\theta JC}$ | Thermal Resistance,<br>Junction to Case                  | 1.67 | 1.67 | 1.67 | $^{\circ}\text{C}/\text{W}$ |
| $R_{\theta JA}$ | Thermal Resistance,<br>Junction to Ambient               | 60   | 60   | 60   | $^{\circ}\text{C}/\text{W}$ |
| $P_D$           | Total Power Dissipation<br>at $T_C = 25^{\circ}\text{C}$ | 75   | 75   | 75   | W                           |

**Notes**

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

## IRF430-433/IRF830-833

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

| Symbol                     | Characteristic                              | Min | Max       | Unit          | Test Conditions                                                                                 |
|----------------------------|---------------------------------------------|-----|-----------|---------------|-------------------------------------------------------------------------------------------------|
| <b>Off Characteristics</b> |                                             |     |           |               |                                                                                                 |
| $V_{(BR)DSS}$              | Drain Source Breakdown Voltage <sup>1</sup> |     |           | V             | $V_{GS} = 0\text{ V}$ , $I_D = 250\text{ }\mu\text{A}$                                          |
|                            | IRF430/432/830/832                          | 500 |           |               |                                                                                                 |
|                            | IRF431/433/831/833                          | 450 |           |               |                                                                                                 |
| $I_{DSS}$                  | Zero Gate Voltage Drain Current             |     | 250       | $\mu\text{A}$ | $V_{DS} = \text{Rated } V_{DSS}$ , $V_{GS} = 0\text{ V}$                                        |
|                            |                                             |     | 1000      | $\mu\text{A}$ | $V_{DS} = 0.8 \times \text{Rated } V_{DSS}$ , $V_{GS} = 0\text{ V}$ , $T_C = 125^\circ\text{C}$ |
| $I_{GSS}$                  | Gate-Body Leakage Current                   |     |           | nA            | $V_{GS} = \pm 20\text{ V}$ , $V_{DS} = 0\text{ V}$                                              |
|                            | IRF430-433                                  |     | $\pm 100$ |               |                                                                                                 |
|                            | IRF830-833                                  |     | $\pm 500$ |               |                                                                                                 |

## On Characteristics

|              |                                                |     |     |                |                                                    |
|--------------|------------------------------------------------|-----|-----|----------------|----------------------------------------------------|
| $V_{GS(th)}$ | Gate Threshold Voltage                         | 2.0 | 4.0 | V              | $I_D = 250\text{ }\mu\text{A}$ , $V_{DS} = V_{GS}$ |
| $R_{DS(on)}$ | Static Drain-Source On-Resistance <sup>2</sup> |     |     | $\Omega$       | $V_{GS} = 10\text{ V}$ , $I_D = 2.5\text{ A}$      |
|              | IRF430/431/830/831                             |     | 1.5 |                |                                                    |
|              | IRF432/433/832/833                             |     | 2.0 |                |                                                    |
| $g_{fs}$     | Forward Transconductance                       | 2.5 |     | S ( $\Omega$ ) | $V_{DS} = 10\text{ V}$ , $I_D = 2.5\text{ A}$      |

## Dynamic Characteristics

|           |                              |  |     |    |                                                                        |
|-----------|------------------------------|--|-----|----|------------------------------------------------------------------------|
| $C_{iss}$ | Input Capacitance            |  | 800 | pF | $V_{DS} = 25\text{ V}$ , $V_{GS} = 0\text{ V}$<br>$f = 1.0\text{ MHz}$ |
| $C_{oss}$ | Output Capacitance           |  | 200 | pF |                                                                        |
| $C_{rss}$ | Reverse Transfer Capacitance |  | 60  | pF |                                                                        |

Switching Characteristics ( $T_C = 25^\circ\text{C}$ , Figures 12, 13)

|              |                     |  |    |    |                                                                                                                                        |
|--------------|---------------------|--|----|----|----------------------------------------------------------------------------------------------------------------------------------------|
| $t_{d(on)}$  | Turn-On Delay Time  |  | 30 | ns | $V_{DD} = 225\text{ V}$ , $I_D = 2.5\text{ A}$<br>$V_{GS} = 10\text{ V}$ , $R_{GEN} = 15\text{ }\Omega$<br>$R_{GS} = 15\text{ }\Omega$ |
| $t_r$        | Rise Time           |  | 30 | ns |                                                                                                                                        |
| $t_{d(off)}$ | Turn-Off Delay Time |  | 55 | ns |                                                                                                                                        |
| $t_f$        | Fall Time           |  | 30 | ns |                                                                                                                                        |
| $Q_g$        | Total Gate Charge   |  | 30 | nC | $V_{GS} = 10\text{ V}$ , $I_D = 7.0\text{ A}$<br>$V_{DS} = 180\text{ V}$                                                               |

| Symbol                                    | Characteristic        | Typ | Max | Unit | Test Conditions                                             |
|-------------------------------------------|-----------------------|-----|-----|------|-------------------------------------------------------------|
| <b>Source-Drain Diode Characteristics</b> |                       |     |     |      |                                                             |
| $V_{SD}$                                  | Diode Forward Voltage |     |     | V    | $I_S = 4.5\text{ A}$ , $V_{GS} = 0\text{ V}$                |
|                                           | IRF430/431/830/831    |     | 1.4 |      |                                                             |
|                                           | IRF432/433/832/833    |     | 1.3 | V    | $I_S = 4.0\text{ A}$ , $V_{GS} = 0\text{ V}$                |
| $t_{rr}$                                  | Reverse Recovery Time | 600 |     | ns   | $I_S = 4.5\text{ A}$ , $di_S/dt = 100\text{ A}/\mu\text{S}$ |

## Notes

- $T_J = +25^\circ\text{C}$  to  $+150^\circ\text{C}$
- Pulse test: Pulse width  $\leq 80\text{ }\mu\text{s}$ , Duty cycle  $\leq 1\%$

## MTM/MTP4N45/4N50

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

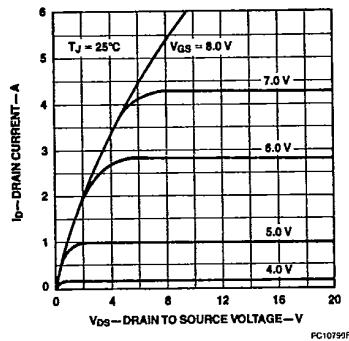
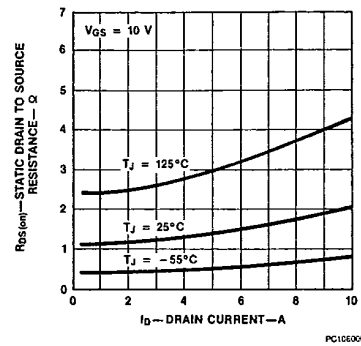
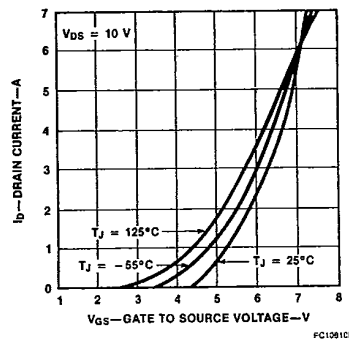
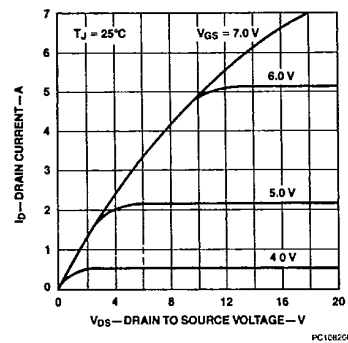
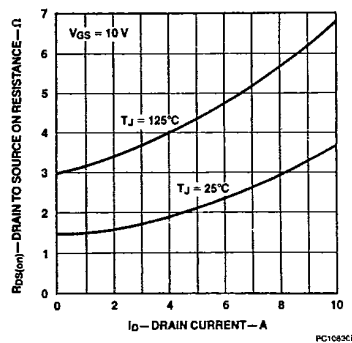
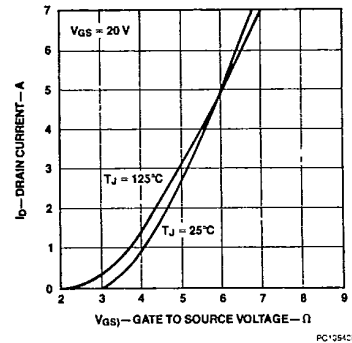
| Symbol                                                                              | Characteristic                                 | Min | Max       | Unit           | Test Conditions                                                                                                                       |
|-------------------------------------------------------------------------------------|------------------------------------------------|-----|-----------|----------------|---------------------------------------------------------------------------------------------------------------------------------------|
| Off Characteristics                                                                 |                                                |     |           |                |                                                                                                                                       |
| $V_{(BR)DSS}$                                                                       | Drain Source Breakdown Voltage <sup>1</sup>    |     |           | V              | $V_{GS} = 0\text{ V}$ , $I_D = 5.0\text{ mA}$                                                                                         |
|                                                                                     | MTM/MTP4N50                                    | 500 |           |                |                                                                                                                                       |
|                                                                                     | MTM/MTP4N45                                    | 450 |           |                |                                                                                                                                       |
| $I_{DSS}$                                                                           | Zero Gate Voltage Drain Current                |     | 0.25      | mA             | $V_{DS} = 0.85 \times \text{Rated } V_{DSS}$ ,<br>$V_{GS} = 0\text{ V}$                                                               |
|                                                                                     |                                                |     | 2.5       | mA             | $V_{DS} = 0.85 \times \text{Rated } V_{DSS}$ ,<br>$V_{GS} = 0\text{ V}$ , $T_C = 100^\circ\text{C}$                                   |
| $I_{GSS}$                                                                           | Gate-Body Leakage Current                      |     | $\pm 500$ | nA             | $V_{GS} = \pm 20\text{ V}$ , $V_{DS} = 0\text{ V}$                                                                                    |
| On Characteristics                                                                  |                                                |     |           |                |                                                                                                                                       |
| $V_{GS(th)}$                                                                        | Gate Threshold Voltage                         | 2.0 | 4.5       | V              | $I_D = 1.0\text{ mA}$ , $V_{DS} = V_{GS}$                                                                                             |
|                                                                                     |                                                | 1.5 | 4.0       | V              | $I_D = 1.0\text{ mA}$ , $V_{DS} = V_{GS}$ ,<br>$T_C = 100^\circ\text{C}$                                                              |
| $R_{DS(on)}$                                                                        | Static Drain-Source On-Resistance <sup>2</sup> |     | 1.5       | $\Omega$       | $V_{GS} = 10\text{ V}$ , $I_D = 2.0\text{ A}$                                                                                         |
| $V_{DS(on)}$                                                                        | Drain-Source On-Voltage <sup>2</sup>           |     | 3.0       | V              | $V_{GS} = 10\text{ V}$ , $I_D = 2.0\text{ V}$                                                                                         |
|                                                                                     |                                                |     | 7.0       | V              | $V_{GS} = 10\text{ V}$ , $I_D = 4.0\text{ A}$                                                                                         |
|                                                                                     |                                                |     | 6.0       | V              | $V_{GS} = 10\text{ V}$ , $I_D = 4.0\text{ A}$<br>$T_C = 100^\circ\text{C}$                                                            |
| $g_{fs}$                                                                            | Forward Transconductance                       | 2.0 |           | S ( $\Omega$ ) | $V_{DS} = 10\text{ V}$ , $I_D = 2.0\text{ A}$                                                                                         |
| Dynamic Characteristics                                                             |                                                |     |           |                |                                                                                                                                       |
| $C_{iss}$                                                                           | Input Capacitance                              |     | 1200      | pF             | $V_{DS} = 25\text{ V}$ , $V_{GS} = 0\text{ V}$<br>$f = 1.0\text{ MHz}$                                                                |
| $C_{oss}$                                                                           | Output Capacitance                             |     | 300       | pF             |                                                                                                                                       |
| $C_{rss}$                                                                           | Reverse Transfer Capacitance                   |     | 80        | pF             |                                                                                                                                       |
| Switching Characteristics ( $T_C = 25^\circ\text{C}$ , Figures 12, 13) <sup>3</sup> |                                                |     |           |                |                                                                                                                                       |
| $t_{d(on)}$                                                                         | Turn-On Delay Time                             |     | 50        | ns             | $V_{DD} = 25\text{ V}$ , $I_D = 2.0\text{ A}$<br>$V_{GS} = 10\text{ V}$ , $R_{GEN} = 50\text{ }\Omega$<br>$R_{GS} = 50\text{ }\Omega$ |
| $t_r$                                                                               | Rise Time                                      |     | 100       | ns             |                                                                                                                                       |
| $t_{d(off)}$                                                                        | Turn-Off Delay Time                            |     | 200       | ns             |                                                                                                                                       |
| $t_f$                                                                               | Fall Time                                      |     | 100       | ns             |                                                                                                                                       |
| $Q_g$                                                                               | Total Gate Charge                              |     | 60        | nC             | $V_{GS} = 10\text{ V}$ , $I_D = 7.0\text{ A}$<br>$V_{DD} = 180\text{ V}$                                                              |

**Notes**1.  $T_J = +25^\circ\text{C}$  to  $+150^\circ\text{C}$ 2. Pulse test: Pulse width  $\leq 80\text{ }\mu\text{s}$ , Duty cycle  $\leq 1\%$ 

3. Switching time measurements performed on LEM TR-58 test equipment.

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**Typical Performance Curves** Figures 4-6 for IRF 432/433/832/833 only.**Figure 1 Output Characteristics****Figure 2 Static Drain to Source Resistance vs Drain Current****Figure 3 Transfer Characteristics****Figure 4 Output Characteristics****Figure 5 Static Drain to Source On Resistance vs Drain Current****Figure 6 Transfer Characteristics**



IRF430-433/IRF830-833  
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## Typical Electrical Characteristics

Figure 12 Switching Test Circuit

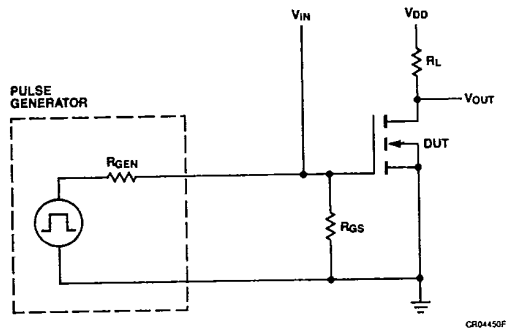


Figure 13 Switching Waveforms

