

**FAIRCHILD**  
A Schlumberger Company

# IRF350-353

## N-channel Power MOSFETs, 15 A, 350 V/400 V

T-39-13

Power And Discrete Division

**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

**Maximum Ratings**

| Symbol            | Characteristic                                                                | Rating<br>IRF350/352 | Rating<br>IRF351/353 | Unit               |
|-------------------|-------------------------------------------------------------------------------|----------------------|----------------------|--------------------|
| $V_{DSS}$         | Drain to Source Voltage                                                       | 400                  | 350                  | V                  |
| $V_{DGR}$         | Drain to Gate Voltage<br>$R_{GS} = 1.0 \text{ M}\Omega$                       | 400                  | 350                  | V                  |
| $V_{GS}$          | Gate to Source Voltage                                                        | $\pm 20$             | $\pm 20$             | V                  |
| $T_J$ , $T_{stg}$ | Operating Junction and<br>Storage Temperatures                                | -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**

|              |                                         | IRF350/351 | IRF352/353 |          |
|--------------|-----------------------------------------|------------|------------|----------|
| $R_{DS(on)}$ | Static Drain-to-Source<br>On Resistance | 0.3        | 0.4        | $\Omega$ |
| $I_D$        | Drain Current<br>Continuous<br>Pulsed   | 15<br>60   | 13<br>52   | A        |

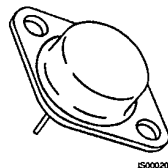
**Maximum Thermal Characteristics**

|                 |                                                          |      |      |                      |
|-----------------|----------------------------------------------------------|------|------|----------------------|
| $R_{\theta JC}$ | Thermal Resistance,<br>Junction to Case                  | 0.83 | 0.83 | $^{\circ}\text{C/W}$ |
| $P_D$           | Total Power Dissipation<br>at $T_C = 25^{\circ}\text{C}$ | 150  | 150  | W                    |

**Notes**

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

TO-204AA



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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             | $V_{GS} = 0\text{ V}$ , $I_D = 250\text{ }\mu\text{A}$                                          |
|                            | IRF350/352                                  | 400 |           |               |                                                                                                 |
|                            | IRF351/353                                  | 350 |           |               |                                                                                                 |
| $I_{DSS}$                  | 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                   |     | $\pm 100$ | nA            | $V_{GS} = \pm 20\text{ V}$ , $V_{DS} = 0\text{ V}$                                              |

## 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> |     |     | $\Omega$       | $V_{GS} = 10\text{ V}$ , $I_D = 8.0\text{ A}$      |
|              | IRF350/351                                     |     | 0.3 |                |                                                    |
|              | IRF352/353                                     |     | 0.4 |                |                                                    |
| $g_{fs}$     | Forward Transconductance                       | 8.0 |     | S ( $\Omega$ ) | $V_{DS} = 10\text{ V}$ , $I_D = 8.0\text{ A}$      |

## Dynamic Characteristics

|           |                              |  |      |    |                                                                        |
|-----------|------------------------------|--|------|----|------------------------------------------------------------------------|
| $C_{iss}$ | Input Capacitance            |  | 3000 | pF | $V_{DS} = 25\text{ V}$ , $V_{GS} = 0\text{ V}$<br>$f = 1.0\text{ MHz}$ |
| $C_{oss}$ | Output Capacitance           |  | 600  | pF |                                                                        |
| $C_{rss}$ | Reverse Transfer Capacitance |  | 200  | pF |                                                                        |

Switching Characteristics ( $T_C = 25^\circ\text{C}$ , Figures 9, 10)

|              |                     |  |     |    |                                                                                                                                          |
|--------------|---------------------|--|-----|----|------------------------------------------------------------------------------------------------------------------------------------------|
| $t_{d(on)}$  | Turn-On Delay Time  |  | 35  | ns | $V_{DD} = 180\text{ V}$ , $I_D = 8.0\text{ A}$<br>$V_{GS} = 10\text{ V}$ , $R_{GEN} = 4.7\text{ }\Omega$<br>$R_{GS} = 4.7\text{ }\Omega$ |
| $t_r$        | Rise Time           |  | 65  | ns |                                                                                                                                          |
| $t_{d(off)}$ | Turn-Off Delay Time |  | 150 | ns |                                                                                                                                          |
| $t_f$        | Fall Time           |  | 75  | ns |                                                                                                                                          |
| $Q_g$        | Total Gate Charge   |  | 120 | nC | $V_{GS} = 10\text{ V}$ , $I_D = 16\text{ A}$<br>$V_{DD} = 400\text{ V}$                                                                  |

| Symbol                                    | Characteristic           | Typ | Max        | Unit | Test Conditions                                                                            |
|-------------------------------------------|--------------------------|-----|------------|------|--------------------------------------------------------------------------------------------|
| <b>Source-Drain Diode Characteristics</b> |                          |     |            |      |                                                                                            |
| $V_{SD}$                                  | Diode Forward Voltage    |     |            | V    | $I_S = 15\text{ A}$ ; $V_{GS} = 0\text{ V}$<br>$I_S = 13\text{ A}$ ; $V_{GS} = 0\text{ V}$ |
|                                           | IRF350/351<br>IRF352/353 |     | 1.6<br>1.5 | V    |                                                                                            |
| $t_{rr}$                                  | Reverse Recovery Time    | 600 |            | ns   | $I_S = 15\text{ A}$ ; $dI_S/dt = 100\text{ A}/\mu\text{S}$                                 |

## 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  $\leq 1\%$

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## Typical Performance Curves

Figure 1 Output Characteristics

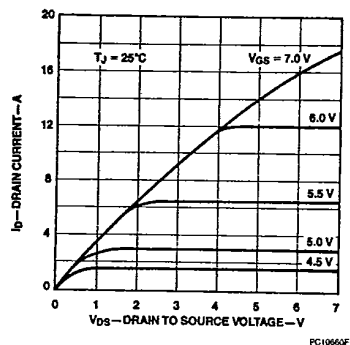


Figure 2 Static Drain to Source On Resistance vs Drain Current

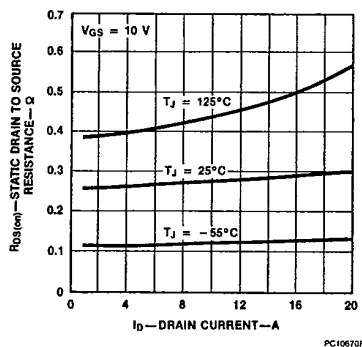


Figure 3 Transfer Characteristics

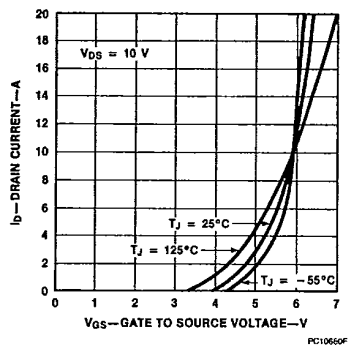


Figure 4 Temperature Variation of Gate to Source Threshold Voltage

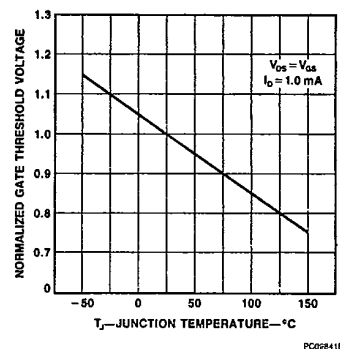


Figure 5 Capacitance vs Drain to Source Voltage

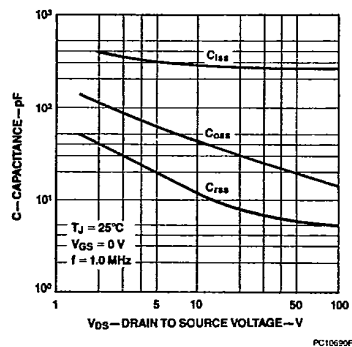
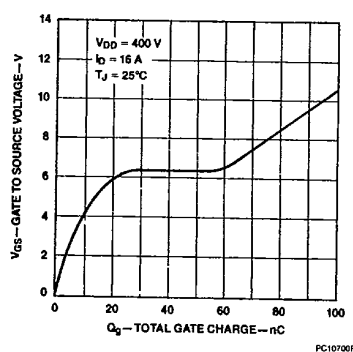


Figure 6 Gate to Source Voltage vs Total Gate Charge



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## Typical Performance Curves (Cont.)

Figure 7 Forward Biased Safe Operating Area

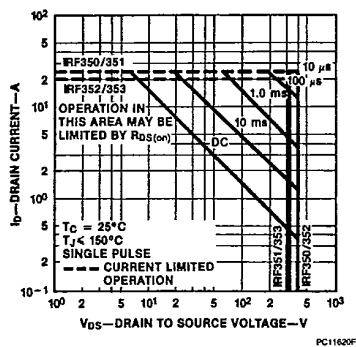
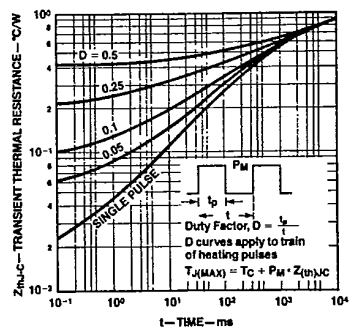


Figure 8 Transient Thermal Resistance vs Time



## Typical Electrical Characteristics

Figure 9 Switching Test Circuit

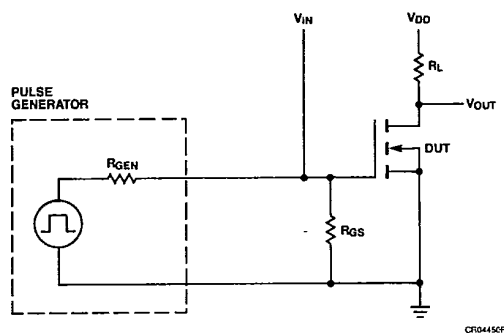


Figure 10 Switching Waveforms

