

## N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTORS

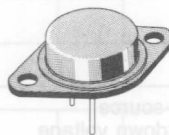
| TYPE   | V <sub>DSS</sub> | R <sub>DS(on)</sub> | I <sub>D</sub> |
|--------|------------------|---------------------|----------------|
| IRF150 | 100 V            | 0.055 Ω             | 40 A           |
| IRF151 | 60 V             | 0.055 Ω             | 40 A           |
| IRF152 | 100 V            | 0.08 Ω              | 33 A           |
| IRF153 | 60 V             | 0.08 Ω              | 33 A           |

- 60-100 VOLTS - FOR DC/DC CONVERTERS
- HIGH CURRENT
- RATED FOR UNCLAMPED INDUCTIVE SWITCHING (ENERGY TEST) ♦
- ULTRA FAST SWITCHING
- EASY DRIVE - FOR REDUCED COST AND SIZE

### INDUSTRIAL APPLICATIONS:

- UNINTERRUPTIBLE POWER SUPPLIES
- MOTOR CONTROLS

N - channel enhancement mode POWER MOS field effect transistors. Easy drive and very fast switching times make these POWER MOS transistors ideal for high speed switching applications. Applications include DC/DC converters, UPS, battery chargers, secondary regulators, servo control, power audio amplifiers and robotics.



TO-3

### INTERNAL SCHEMATIC DIAGRAM



### ABSOLUTE MAXIMUM RATINGS

|                     |                                                 | IRF |            |     |     |
|---------------------|-------------------------------------------------|-----|------------|-----|-----|
|                     |                                                 | 150 | 151        | 152 | 153 |
| V <sub>DS</sub> *   | Drain-source voltage (V <sub>GS</sub> = 0)      | 100 | 60         | 100 | 60  |
| V <sub>DGR</sub> *  | Drain-gate voltage (R <sub>GS</sub> = 20 KΩ)    | 100 | 60         | 100 | 60  |
| V <sub>GS</sub>     | Gate-source voltage                             |     | ±20        |     |     |
| I <sub>D</sub>      | Drain current (cont.) at T <sub>c</sub> = 25°C  | 40  | 40         | 33  | 33  |
| I <sub>D</sub>      | Drain current (cont.) at T <sub>c</sub> = 100°C | 25  | 25         | 20  | 20  |
| I <sub>DM</sub> (*) | Drain current (pulsed)                          | 160 | 160        | 132 | 132 |
| P <sub>tot</sub>    | Total dissipation at T <sub>c</sub> < 25°C      |     | 150        |     |     |
|                     | Derating factor                                 |     | 1.2        |     |     |
| T <sub>stg</sub>    | Storage temperature                             |     | -55 to 150 |     |     |
| T <sub>j</sub>      | Max. operating junction temperature             |     | 150        |     |     |

\* T<sub>j</sub> = 25°C to 125°C

(\*) Repetitive Rating: Pulse width limited by max junction temperature

♦ Introduced in 1988 week 44

## THERMAL DATA

|                |                                                |     |      |      |
|----------------|------------------------------------------------|-----|------|------|
| $R_{thj-case}$ | Thermal resistance junction-case               | max | 0.83 | °C/W |
| $R_{thc-s}$    | Thermal resistance case-sink                   | typ | 0.1  | °C/W |
| $R_{thj-amb}$  | Thermal resistance junction-ambient            | max | 30   | °C/W |
| $T_l$          | Maximum lead temperature for soldering purpose |     | 300  | °C   |

ELECTRICAL CHARACTERISTICS ( $T_{case} = 25^\circ\text{C}$  unless otherwise specified)

| Parameters | Test Conditions | Min. | Typ. | Max. | Unit |
|------------|-----------------|------|------|------|------|
|------------|-----------------|------|------|------|------|

## OFF

|               |                                                  |                                                                                  |                           |             |                                |
|---------------|--------------------------------------------------|----------------------------------------------------------------------------------|---------------------------|-------------|--------------------------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage                   | $I_D = 250\ \mu\text{A}$<br>for <b>IRF150/IRF152</b><br>for <b>IRF151/IRF153</b> | $V_{GS} = 0$              | 100<br>60   | V<br>V                         |
| $I_{DSS}$     | Zero gate voltage drain current ( $V_{GS} = 0$ ) | $V_{DS} = \text{Max Rating}$<br>$V_{DS} = \text{Max Rating} \times 0.8$          | $T_c = 125^\circ\text{C}$ | 250<br>1000 | $\mu\text{A}$<br>$\mu\text{A}$ |
| $I_{GSS}$     | Gate-body leakage current ( $V_{DS} = 0$ )       | $V_{GS} = \pm 20\ \text{V}$                                                      |                           | $\pm 100$   | nA                             |

## ON \*\*

|              |                                   |                                                                                                     |                          |          |               |                      |
|--------------|-----------------------------------|-----------------------------------------------------------------------------------------------------|--------------------------|----------|---------------|----------------------|
| $V_{GS(th)}$ | Gate threshold voltage            | $V_{DS} = V_{GS}$                                                                                   | $I_D = 250\ \mu\text{A}$ | 2        | 4             | V                    |
| $I_{D(on)}$  | On-state drain current            | $V_{DS} > I_{D(on)} \times R_{DS(on) \max}$<br>for <b>IRF150/IRF151</b><br>for <b>IRF152/IRF153</b> | $V_{GS} = 10\ \text{V}$  | 40<br>33 |               | A<br>A               |
| $R_{DS(on)}$ | Static drain-source on resistance | $V_{GS} = 10\ \text{V}$<br>for <b>IRF150/IRF151</b><br>for <b>IRF152/IRF153</b>                     | $I_D = 20\ \text{A}$     |          | 0.055<br>0.08 | $\Omega$<br>$\Omega$ |

## ENERGY TEST

|           |                                                      |                                                                                                                      |                        |          |  |        |
|-----------|------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|------------------------|----------|--|--------|
| $I_{UIS}$ | Unclamped inductive switching current (single pulse) | $V_{DD} = 30\ \text{V}$<br>starting $T_l = 25^\circ\text{C}$<br>for <b>IRF150/IRF151</b><br>for <b>IRF152/IRF153</b> | $L = 100\ \mu\text{H}$ | 40<br>33 |  | A<br>A |
|-----------|------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|------------------------|----------|--|--------|

## DYNAMIC

|               |                              |                                                                     |   |      |  |     |
|---------------|------------------------------|---------------------------------------------------------------------|---|------|--|-----|
| $g_{fs}^{**}$ | Forward transconductance     | $V_{DS} > I_{D(on)} \times R_{DS(on) \max}$<br>$I_D = 20\ \text{A}$ | 9 |      |  | mho |
| $C_{iss}$     | Input capacitance            | $V_{DS} = 25\ \text{V}$                                             |   | 3000 |  | pF  |
| $C_{oss}$     | Output capacitance           | $f = 1\ \text{MHz}$                                                 |   | 1500 |  | pF  |
| $C_{rss}$     | Reverse transfer capacitance | $V_{GS} = 0$                                                        |   | 500  |  | pF  |

# ELECTRICAL CHARACTERISTICS (Continued)

| Parameters                                  | Test Conditions                                                                                                                                             | Min. | Typ. | Max.                    | Unit                 |
|---------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|-------------------------|----------------------|
| $t_d$ (on)<br>$t_r$<br>$t_d$ (off)<br>$t_f$ | Turn-on time<br>Rise time<br>Turn-off delay time<br>Fall time<br>$V_{DD} = 24\text{ V}$<br>$R_i = 4.7\ \Omega$<br>$I_D = 20\text{ A}$<br>(see test circuit) |      |      | 35<br>100<br>125<br>100 | ns<br>ns<br>ns<br>ns |
| $Q_g$                                       | Total Gate Charge<br>$V_{GS} = 10\text{ V}$<br>$V_{DS} = \text{Max Rating} \times 0.8$<br>(see test circuit)                                                |      |      | 120                     | nC                   |

## SOURCE DRAIN DIODE

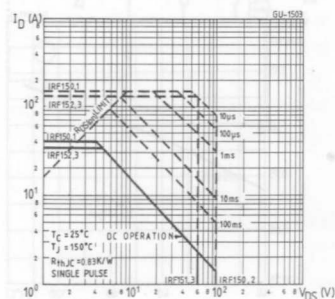
|                      |                                                   |                                                        |                                                  |            |                     |
|----------------------|---------------------------------------------------|--------------------------------------------------------|--------------------------------------------------|------------|---------------------|
| $I_{SD}$             | Source-drain current                              | for IRF150/IRF151<br>for IRF152/IRF153                 |                                                  | 40<br>33   | A<br>A              |
| $I_{SDM}$ (*)        | Source-drain current (pulsed)                     | for IRF150/IRF151<br>for IRF152/IRF153                 |                                                  | 160<br>132 | A<br>A              |
| $V_{SD}^{**}$        | Forward on voltage                                | $V_{GS} = 0$<br>for IRF150/IRF151<br>for IRF152/IRF153 | $I_{SD} = 40\text{ A}$<br>$I_{SD} = 33\text{ A}$ | 2.5<br>2.3 | V<br>V              |
| $t_{rr}$<br>$Q_{rr}$ | Reverse recovery time<br>Reverse recovered charge | $T_j = 150^\circ\text{C}$<br>$I_{SD} = 40\text{ A}$    | $di/dt = 100\text{ A}/\mu\text{s}$               | 600<br>3.3 | ns<br>$\mu\text{C}$ |

\*\* Pulsed: Pulse duration  $\leq 300\ \mu\text{s}$ , duty cycle  $\leq 2\%$

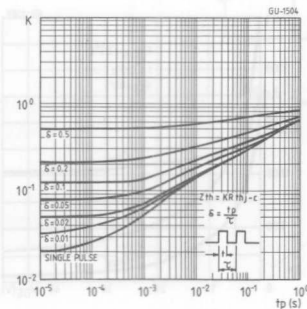
(\*) Repetitive Rating: Pulse width limited by max junction temperature



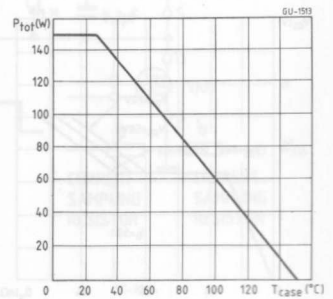
## Safe operating areas



## Thermal impedance



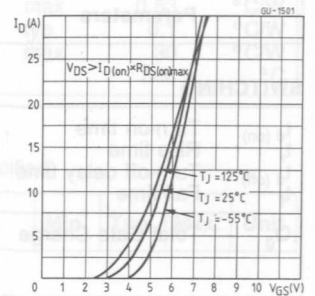
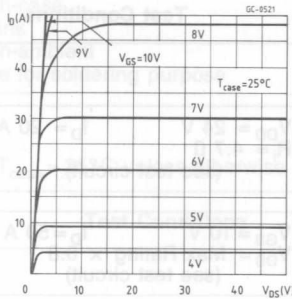
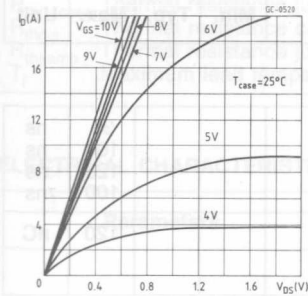
## Derating curve



Output characteristics

Output characteristics

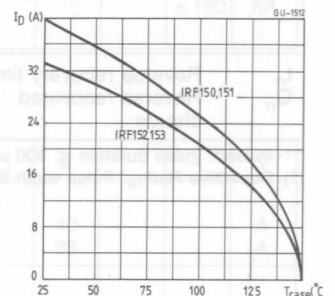
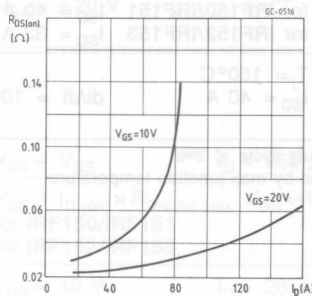
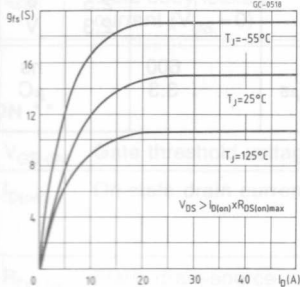
Transfer characteristics



Transconductance

Static drain-source on resistance

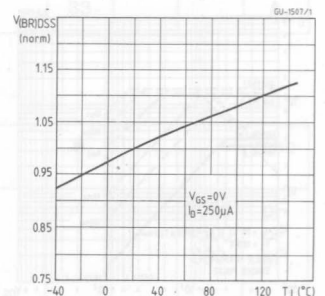
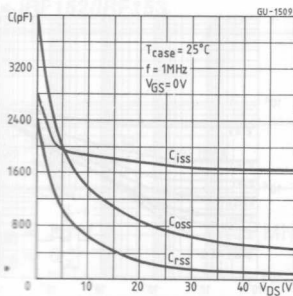
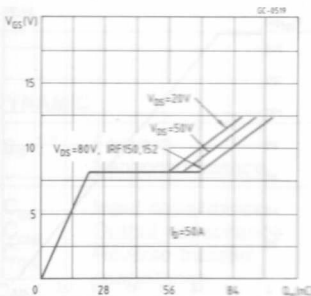
Maximum drain current vs temperature



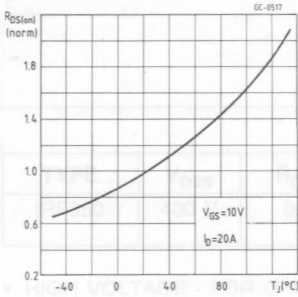
Gate charge vs gate-source voltage

Capacitance variation

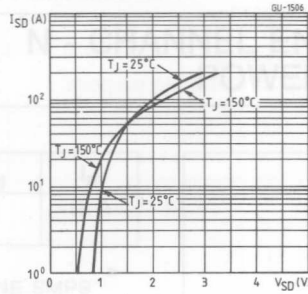
Normalized breakdown voltage vs temperature



# Normalized on resistance vs temperature

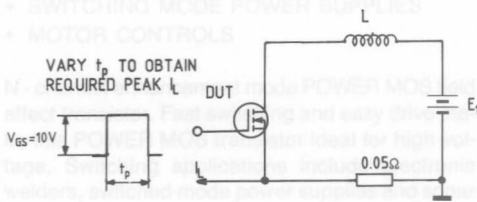


# Source-drain diode forward characteristics

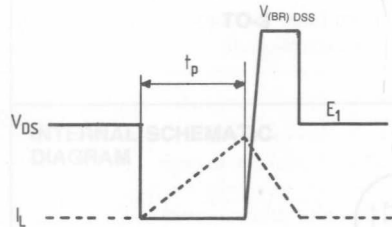


- HIGH CURRENT - FOR SMPS UP TO 250W
- ULTRA FAST SWITCHING - FOR OPERATION AT  $> 100kHz$
- EASY DRIVE - REDUCES SIZE AND COST

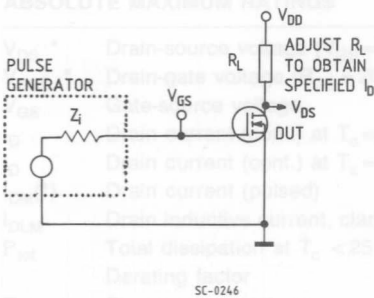
## Unclamped inductive test circuit



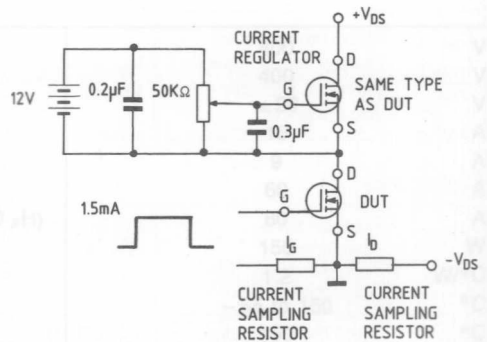
## Unclamped inductive waveforms



## Switching times test circuit



## Gate charge test circuit



•  $T_J = 25^\circ C$  to  $125^\circ C$   
(\*) Repetitive Rating: Pulse width limited by max junction temperature