



# POWER-MOS FET

## FIELD EFFECT POWER TRANSISTOR

**IRF330,331  
D86DQ2,Q1**

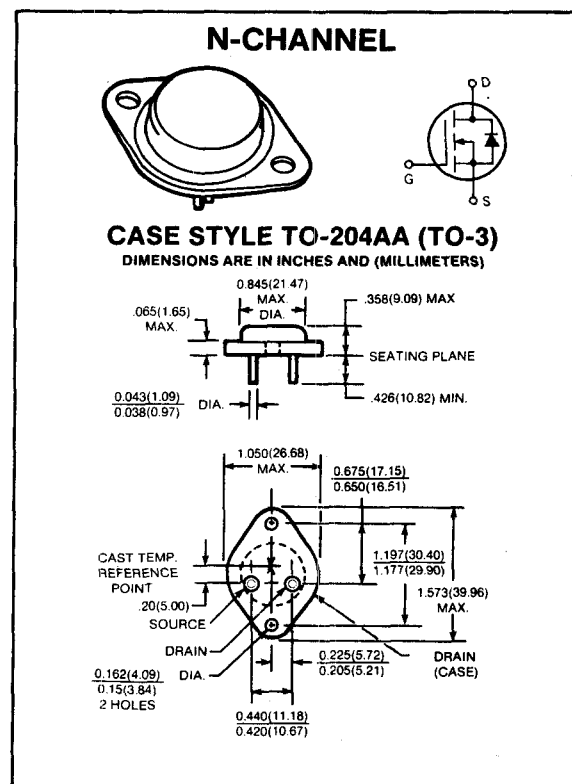
**5.5 AMPERES  
400, 350 VOLTS  
 $R_{DS(ON)} = 1.0 \Omega$**

This series of N-Channel Enhancement-mode Power MOSFETs utilizes GE's advanced Power DMOS technology to achieve low on-resistance with excellent device ruggedness and reliability.

This design has been optimized to give superior performance in most switching applications including: switching power supplies, inverters, converters and solenoid/relay drivers. Also, the extended safe operating area with good linear transfer characteristics makes it well suited for many linear applications such as audio amplifiers and servo motors.

### Features

- Polysilicon gate — Improved stability and reliability
- No secondary breakdown — Excellent ruggedness
- Ultra-fast switching — Independent of temperature
- Voltage controlled — High transconductance
- Low input capacitance — Reduced drive requirement
- Excellent thermal stability — Ease of paralleling



maximum ratings ( $T_C = 25^\circ\text{C}$ ) (unless otherwise specified)

| RATING                                                                                | SYMBOL         | IRF330/D86DQ2 | IRF331/D86DQ1 | UNITS                        |
|---------------------------------------------------------------------------------------|----------------|---------------|---------------|------------------------------|
| Drain-Source Voltage                                                                  | $V_{DS}$       | 400           | 350           | Volts                        |
| Drain-Gate Voltage, $R_{GS} = 1M\Omega$                                               | $V_{DGR}$      | 400           | 350           | Volts                        |
| Continuous Drain Current @ $T_C = 25^\circ\text{C}$<br>@ $T_C = 100^\circ\text{C}$    | $I_D$          | 5.5<br>3.5    | 5.5<br>3.5    | A<br>A                       |
| Pulsed Drain Current <sup>(1)</sup>                                                   | $I_{DM}$       | 22            | 22            | A                            |
| Gate-Source Voltage                                                                   | $V_{GS}$       | $\pm 20$      | $\pm 20$      | Volts                        |
| Total Power Dissipation @ $T_C = 25^\circ\text{C}$<br>Derate Above $25^\circ\text{C}$ | $P_D$          | 75<br>0.6     | 75<br>0.6     | Watts<br>W/ $^\circ\text{C}$ |
| Operating and Storage<br>Junction Temperature Range                                   | $T_J, T_{STG}$ | -55 to 150    | -55 to 150    | $^\circ\text{C}$             |

### thermal characteristics

|                                                                                             |                 |      |      |                    |
|---------------------------------------------------------------------------------------------|-----------------|------|------|--------------------|
| Thermal Resistance, Junction to Case                                                        | $R_{\theta JC}$ | 1.67 | 1.67 | $^\circ\text{C/W}$ |
| Thermal Resistance, Junction to Ambient                                                     | $R_{\theta JA}$ | 30   | 30   | $^\circ\text{C/W}$ |
| Maximum Lead Temperature for Soldering<br>Purposes: $\frac{1}{8}$ " from Case for 5 Seconds | $T_L$           | 260  | 260  | $^\circ\text{C}$   |

(1) Repetitive Rating: Pulse width limited by max. junction temperature.

electrical characteristics ( $T_C = 25^\circ\text{C}$ ) (unless otherwise specified)

| CHARACTERISTIC | SYMBOL | MIN | TYP | MAX | UNIT |
|----------------|--------|-----|-----|-----|------|
|----------------|--------|-----|-----|-----|------|

off characteristics

|                                                                                                                                                                                                               |                                |            |            |                  |                 |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------|------------|------------------|-----------------|
| Drain-Source Breakdown Voltage<br>( $V_{GS} = 0V$ , $I_D = 250\mu A$ )                                                                                                                                        | IRF330/D86DQ2<br>IRF331/D86DQ1 | $BV_{DSS}$ | 400<br>350 | —<br>—           | Volts           |
| Zero Gate Voltage Drain Current<br>( $V_{DS} = \text{Max Rating}$ , $V_{GS} = 0V$ , $T_C = 25^\circ\text{C}$ )<br>( $V_{DS} = \text{Max Rating}$ , $\times 0.8$ , $V_{GS} = 0V$ , $T_C = 125^\circ\text{C}$ ) |                                | $I_{DSS}$  | —<br>—     | —<br>250<br>1000 | $\mu A$         |
| Gate-Source Leakage Current<br>( $V_{GS} = \pm 20V$ )                                                                                                                                                         |                                | $I_{GSS}$  | —          | —                | $\pm 100$<br>nA |

on characteristics\*

|                                                                            |                          |              |     |     |     |       |
|----------------------------------------------------------------------------|--------------------------|--------------|-----|-----|-----|-------|
| Gate Threshold Voltage<br>( $V_{DS} = V_{GS}$ , $I_D = 250\mu A$ )         | $T_C = 25^\circ\text{C}$ | $V_{GS(TH)}$ | 2.0 | —   | 4.0 | Volts |
| On-State Drain Current<br>( $V_{GS} = 10V$ , $V_{DS} = 10V$ )              |                          | $I_{D(ON)}$  | 5.5 | —   | —   | A     |
| Static Drain-Source On-State Resistance<br>( $V_{GS} = 10V$ , $I_D = 3A$ ) |                          | $R_{DS(ON)}$ | —   | 0.8 | 1.0 | Ohms  |
| Forward Transconductance<br>( $V_{DS} = 10V$ , $I_D = 3A$ )                |                          | $g_{fs}$     | 2.1 | 2.5 | —   | mhos  |

dynamic characteristics

|                              |                    |           |   |     |     |    |
|------------------------------|--------------------|-----------|---|-----|-----|----|
| Input Capacitance            | $V_{GS} = 0V$      | $C_{iss}$ | — | 650 | 800 | pF |
| Output Capacitance           | $V_{DS} = 25V$     | $C_{oss}$ | — | 100 | 300 | pF |
| Reverse Transfer Capacitance | $f = 1\text{ MHz}$ | $C_{rss}$ | — | 15  | 80  | pF |

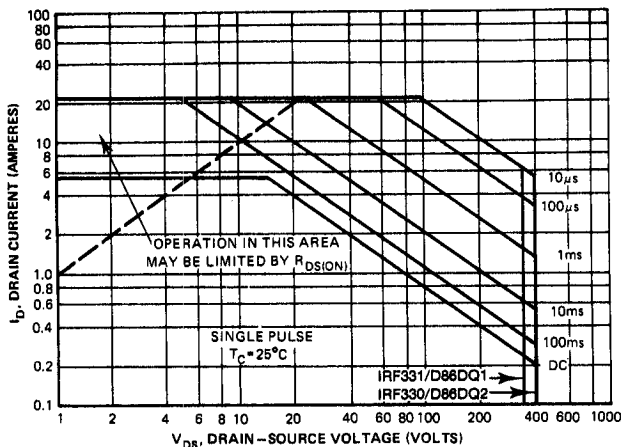
switching characteristics\*

|                     |                                              |              |   |    |   |    |
|---------------------|----------------------------------------------|--------------|---|----|---|----|
| Turn-on Delay Time  | $V_{DS} = 175V$                              | $t_{d(on)}$  | — | 15 | — | ns |
| Rise Time           | $I_D = 3A$ , $V_{GS} = 15V$                  | $t_r$        | — | 20 | — | ns |
| Turn-off Delay Time | $R_{GEN} = 50\Omega$ , $R_{GS} = 12.5\Omega$ | $t_{d(off)}$ | — | 30 | — | ns |
| Fall Time           | ( $R_{GS} \text{ (EQUIV.)} = 10\Omega$ )     | $t_f$        | — | 20 | — | ns |

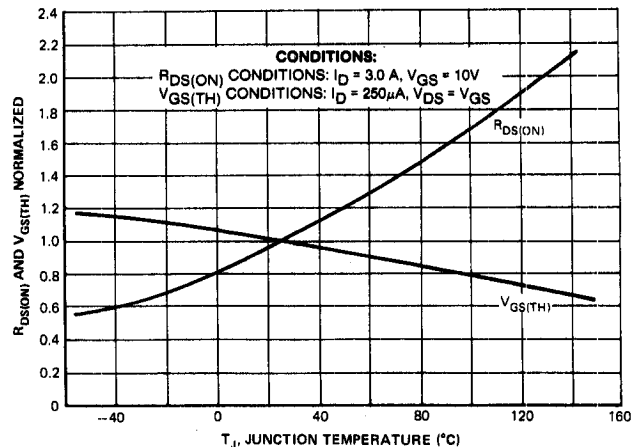
source-drain diode ratings and characteristics\*

|                                                                                                |                      |        |            |        |               |
|------------------------------------------------------------------------------------------------|----------------------|--------|------------|--------|---------------|
| Continuous Source Current                                                                      | $I_S$                | —      | —          | 5.5    | A             |
| Pulsed Source Current                                                                          | $I_{SM}$             | —      | —          | 22     | A             |
| Diode Forward Voltage<br>( $T_C = 25^\circ\text{C}$ , $V_{GS} = 0V$ , $I_S = 5.5A$ )           | $V_{SD}$             | —      | 1.0        | 1.6    | Volts         |
| Reverse Recovery Time<br>( $I_S = 5.5A$ , $dI_S/dt = 100A/\mu s$ , $T_C = 125^\circ\text{C}$ ) | $t_{rr}$<br>$Q_{RR}$ | —<br>— | 360<br>4.0 | —<br>— | ns<br>$\mu C$ |

\*Pulse Test: Pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$



MAXIMUM SAFE OPERATING AREA



TYPICAL NORMALIZED  $R_{DS(ON)}$  AND  $V_{GS(TH)}$  VS. TEMP.