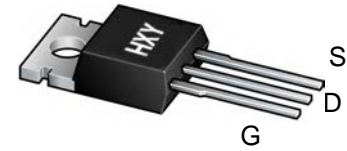




## Description

The IRF640NPBF uses advanced trench technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. It can be used in a wide variety of applications.



TO-220

## General Features

$V_{DS} = 200V, I_D = 18A$

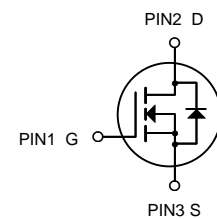
$R_{DS(ON)} < 145m\Omega @ V_{GS} = 10V$

## Application

High efficiency switch mode power supplies

Power factor correction

Electronic lamp ballast



N-Channel MOSFET

## Package Marking and Ordering Information

| Product ID | Pack   | Marking          | Units Tube |
|------------|--------|------------------|------------|
| IRF640NPBF | TO-220 | HXY IRF640N YYYY | 50         |

## Absolute Maximum Ratings@ $T_j = 25^\circ C$ (unless otherwise specified)

| Symbol                               | Parameter                            | Rating     | Units |
|--------------------------------------|--------------------------------------|------------|-------|
| V <sub>DS</sub>                      | Drain-Source Voltage                 | 200        | V     |
| V <sub>GS</sub>                      | Gate-Source Voltage                  | $\pm 20$   | V     |
| I <sub>D</sub> @T <sub>C</sub> =25°C | Drain Current                        | 18         | A     |
| IDM                                  | Pulsed Drain Current <sup>1</sup>    | 72         | A     |
| P <sub>D</sub> @T <sub>C</sub> =25°C | Total Power Dissipation              | 125        | W     |
| TSTG                                 | Storage Temperature Range            | -55 to 150 | °C    |
| T <sub>J</sub>                       | Operating Junction Temperature Range | -55 to 150 | °C    |



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

| Parameter  | Symbol              | Condition  | Min | Typ  | Max  | Unit |
|--|---------------------|--|-----|------|------|------|
| <b>Off Characteristics</b>                         |                     |  |     |      |      |      |
| Drain-Source Breakdown Voltage <sup>(Note 1)</sup> | BV <sub>DSS</sub>   | V <sub>GS</sub> =0V, I <sub>D</sub> =250μA   | 200 | -    | -    | V    |
| Zero Gate Voltage Drain Current                    | I <sub>DSS</sub>    | V <sub>DS</sub> =200V, V <sub>GS</sub> =0V   | -   | -    | 1    | μA   |
| Gate-Body Leakage Current                          | I <sub>GSS</sub>    | V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V   | -   | -    | ±100 | nA   |
| <b>On Characteristics</b>                          |                     |  |     |      |      |      |
| Gate Threshold Voltage                             | V <sub>GS(th)</sub> | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA   | 2.0 | -    | 4.0  | V    |
| Drain-Source On-State Resistance                   | R <sub>DS(ON)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =9A   | -   | 120  | 145  | mΩ   |
| Forward Transconductance                           | g <sub>FS</sub>     | V <sub>DS</sub> =40V, I <sub>D</sub> =5A   | 8   | -    | -    | S    |
| <b>Dynamic Characteristics</b>                     |                     |  |     |      |      |      |
| Input Capacitance                                  | C <sub>iss</sub>    | V <sub>DS</sub> =25V, V <sub>GS</sub> =0V,<br>F=1.0MHz   | -   | 1100 | -    | PF   |
| Output Capacitance                                 | C <sub>oss</sub>    |  | -   | 180  | -    | PF   |
| Reverse Transfer Capacitance                       | C <sub>rss</sub>    |  | -   | 30   | -    | PF   |
| <b>Switching Characteristics</b>                   |                     |  |     |      |      |      |
| Turn-on Delay Time                                 | t <sub>d(on)</sub>  | V <sub>DD</sub> =100V, I <sub>D</sub> =18A<br>R <sub>G</sub> =2.5Ω, V <sub>GS</sub> =10V <sup>(Note 2)</sup> | -   | 11   | -    | nS   |
| Turn-on Rise Time                                  | t <sub>r</sub>      |  | -   | 33   | -    | nS   |
| Turn-Off Delay Time                                | t <sub>d(off)</sub> |  | -   | 25   | -    | nS   |
| Turn-Off Fall Time                                 | t <sub>f</sub>      |  | -   | 7    | -    | nS   |
| Total Gate Charge                                  | Q <sub>g</sub>      | V <sub>DS</sub> =100V, I <sub>D</sub> =18A,<br>V <sub>GS</sub> =10V <sup>(Note 2)</sup>                      | -   | 25   | -    | nC   |
| Gate-Source Charge                                 | Q <sub>gs</sub>     |  | -   | 7.5  | -    | nC   |
| Gate-Drain Charge                                  | Q <sub>gd</sub>     |  | -   | 9.5  | -    | nC   |
| <b>Drain-Source Diode Characteristics</b>          |                     |  |     |      |      |      |
| Diode Forward Voltage                              | V <sub>SD</sub>     | V <sub>GS</sub> =0V, I <sub>S</sub> =9A  | -   | -    | 1.4  | V    |
| Diode Forward Current <sup>(Note 2)</sup>          | I <sub>S</sub>      |  | -   | -    | 18   | A    |

**Notes:**

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.



### Typical Electrical

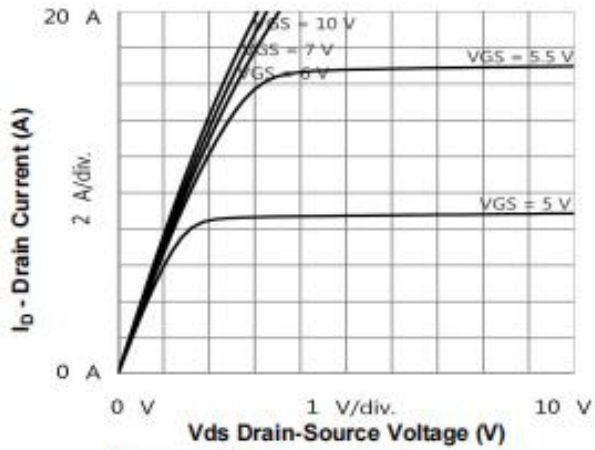


Figure 1. On-Region Characteristics

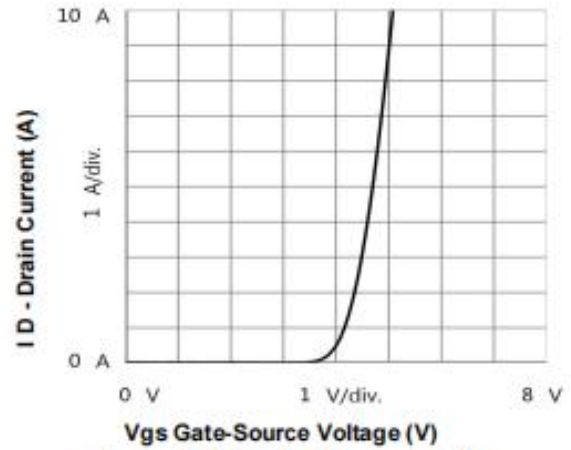


Figure 2. Transfer Characteristics

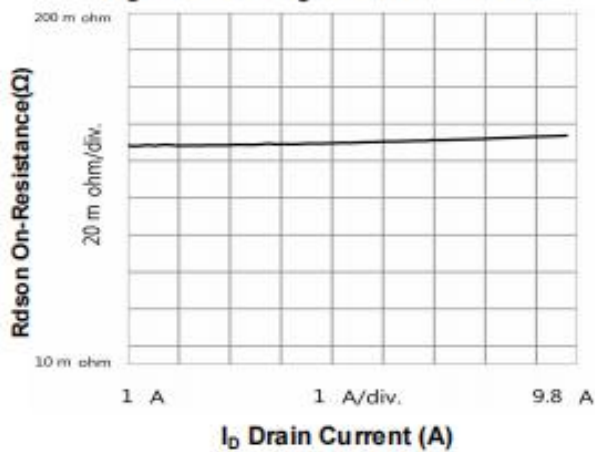


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

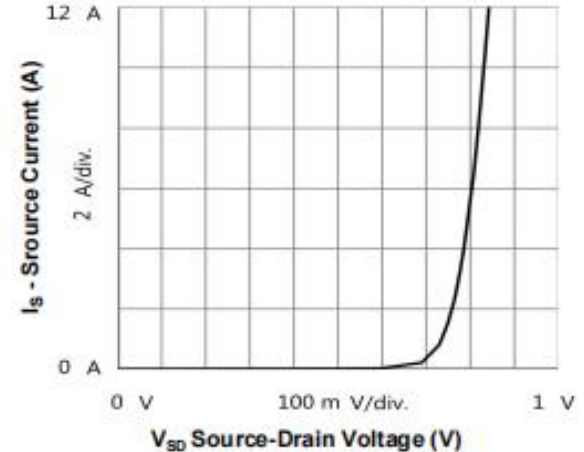


Figure 4. Source Current vs Source-Drain Voltage

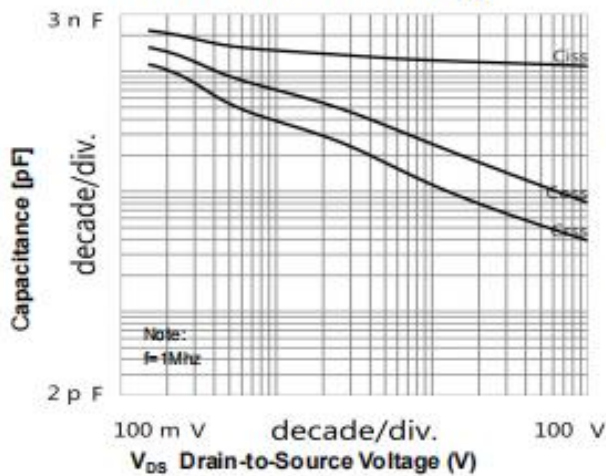


Figure 5.1 Capacitance Characteristics

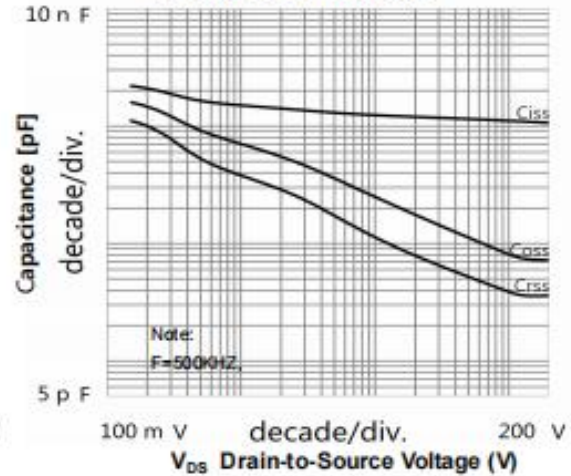


Figure 5.2 Capacitance Characteristics

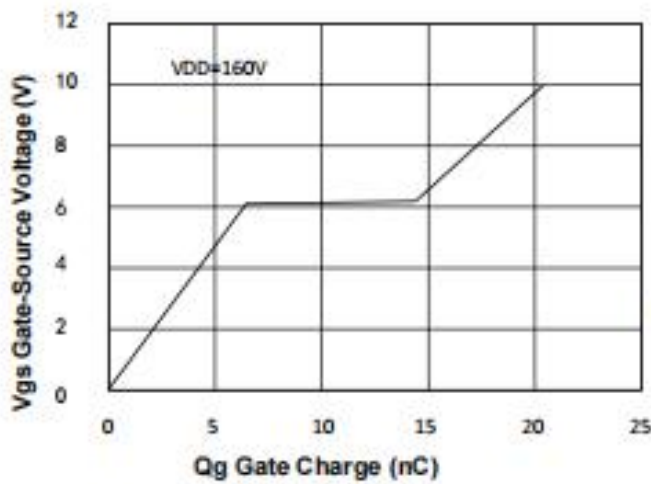


Figure 6. Gate Charge Characteristics

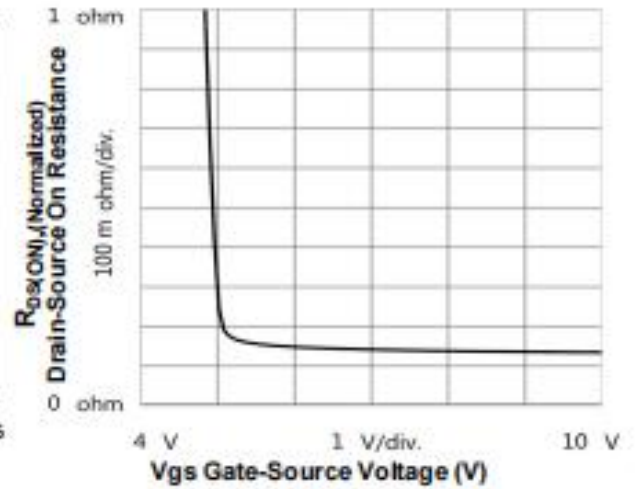


Figure 7. On-Resistance Variation vs Gate-Source Voltage

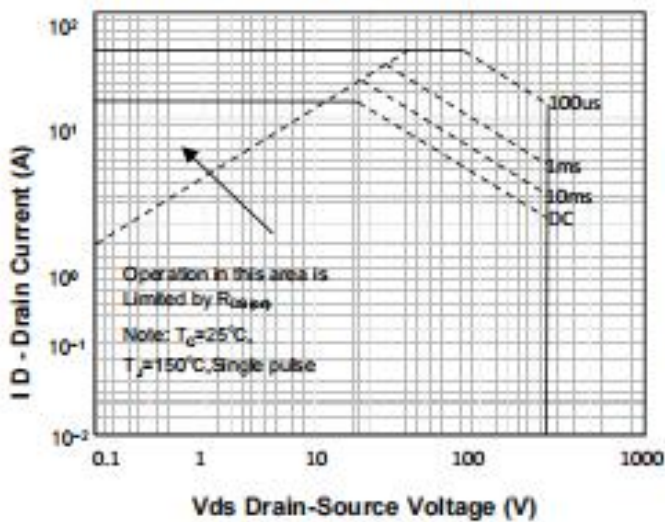


Figure 8. Maximum Safe Operating Area

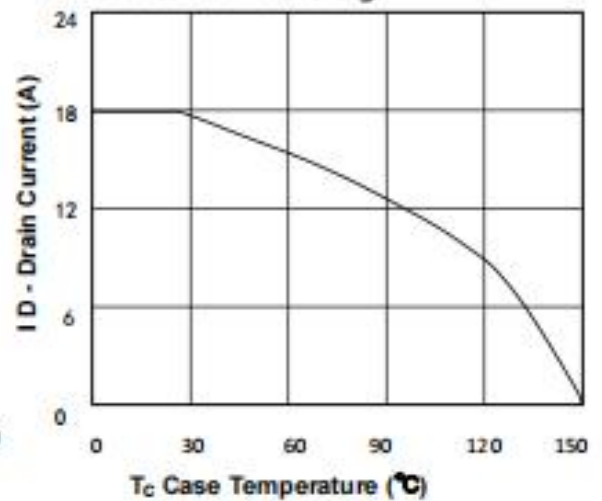


Figure 9. Maximum Drain Current vs Case Temperature

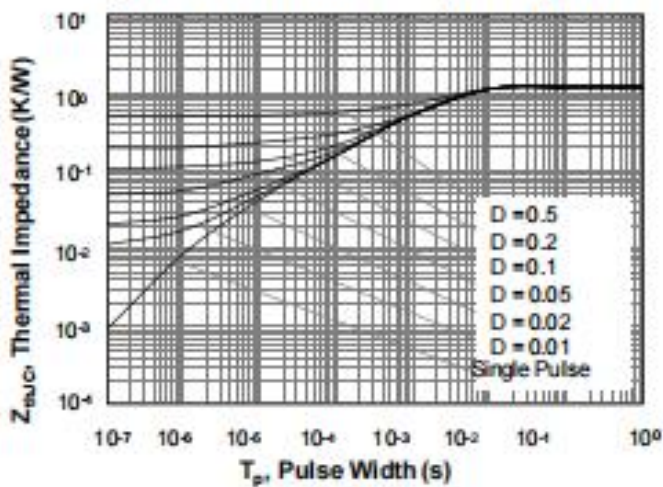
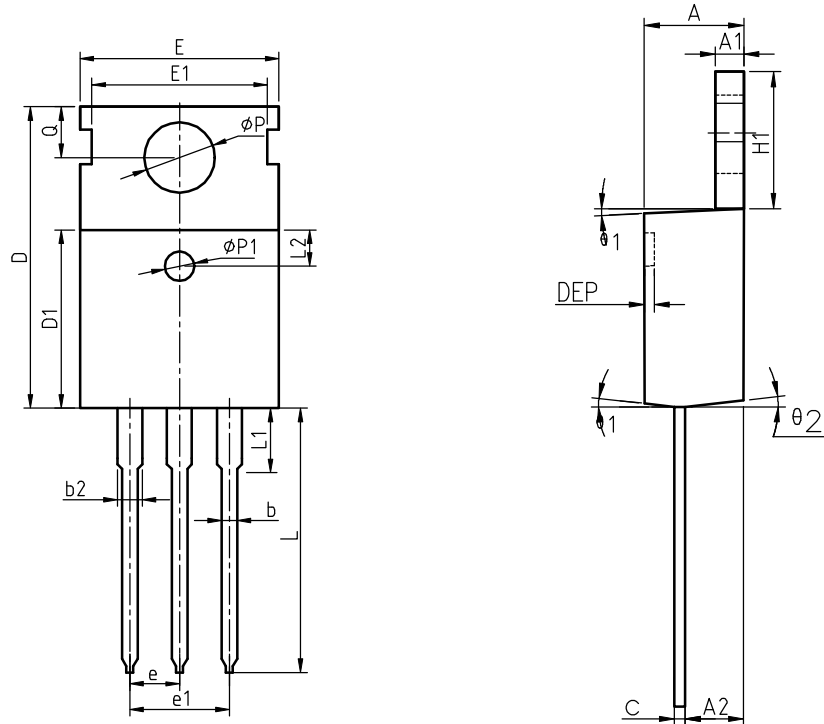


Figure 10. Transient Thermal Response Curve



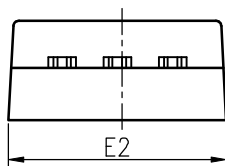
## Package Information

### TO-220



COMMON DIMENSIONS

| SYMBOL     | MIN   | NOM   | MAX   | MIN   | NOM   | MAX   |
|------------|-------|-------|-------|-------|-------|-------|
| A          | 4.40  | 4.57  | 4.70  | 0.173 | 0.180 | 0.185 |
| A1         | 1.27  | 1.30  | 1.33  | 0.050 | 0.051 | 0.052 |
| A2         | 2.35  | 2.40  | 2.50  | 0.093 | 0.094 | 0.098 |
| b          | 0.77  | 0.80  | 0.90  | 0.030 | 0.031 | 0.035 |
| b2         | 1.17  | 1.27  | 1.36  | 0.046 | 0.050 | 0.054 |
| c          | 0.48  | 0.50  | 0.56  | 0.019 | 0.020 | 0.022 |
| D          | 15.40 | 15.60 | 15.80 | 0.606 | 0.614 | 0.622 |
| D1         | 9.00  | 9.10  | 9.20  | 0.354 | 0.358 | 0.362 |
| DEP        | 0.05  | 0.10  | 0.20  | 0.002 | 0.004 | 0.008 |
| E          | 9.80  | 10.00 | 10.20 | 0.386 | 0.394 | 0.402 |
| E1         | -     | 8.70  | -     | -     | 0.343 | -     |
| E2         | 9.80  | 10.00 | 10.20 | 0.386 | 0.394 | 0.402 |
| e          |       | 2.54  | BSC   |       | 0.100 | BSC   |
| e1         |       | 5.08  | BSC   |       | 0.200 | BSC   |
| H1         | 6.40  | 6.50  | 6.60  | 0.252 | 0.256 | 0.260 |
| L          | 12.75 | 13.50 | 13.65 | 0.502 | 0.531 | 0.537 |
| L1         | -     | 3.10  | 3.30  | -     | 0.122 | 0.130 |
| L2         |       | 2.50  | REF   |       | 0.098 | REF   |
| P          | 3.50  | 3.60  | 3.63  | 0.138 | 0.142 | 0.143 |
| P1         | 3.50  | 3.60  | 3.63  | 0.138 | 0.142 | 0.143 |
| Q          | 2.73  | 2.80  | 2.87  | 0.107 | 0.110 | 0.113 |
| $\theta 1$ | 5°    | 7°    | 9°    | 5°    | 7°    | 9°    |
| $\theta 2$ | 1°    | 3°    | 5°    | 1°    | 3°    | 5°    |
| $\theta 3$ | 1°    | 3°    | 5°    | 1°    | 3°    | 5°    |





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