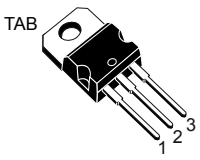
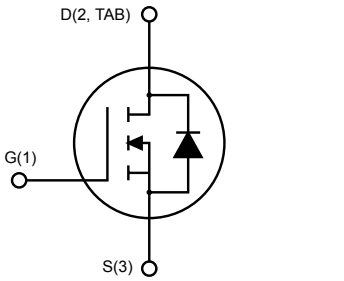
# N-channel 200 V, 0.29 Ω typ., 9 A, STripFET™ Power MOSFET in a TO-220 package




**TO-220**




## Features

| Order code | $V_{DS}$ | $R_{DS(on)}$ max. | $I_D$ |
|---|---|---|---|
| IRF630 | 200 V | 0.40 Ω | 9 A |

- Extremely high dv/dt capability
- Very low intrinsic capacitance
- Gate charge minimized

## Applications

- Switching applications

## Description

This Power MOSFET series realized with STMicroelectronics unique STripFET™ process has specifically been designed to minimize input capacitance and gate charge. It is therefore suitable as primary switch in advanced high-efficiency isolated DC-DC converters.

STPOWER

| Product status link |
|---|
| IRF630 |

| Product summary | |
|---|---|
| **Order code** | IRF630 |
| **Marking** | IRF630 |
| **Package** | TO-220 |
| **Packing** | Tube |

# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{DDS}$ | Drain-source voltage ($V_{GS}$ = 0 V) | 200 | V |
| $V_{DGR}$ | Drain-gate voltage ($R_{GS}$ = 20 kΩ) | 200 | V |
| $V_{GS}$ | Gate-source voltage | ±20 | V |
| $I_D$ | Drain current (continuous) at $T_C$ = 25 °C | 9 | A |
| | Drain current (continuous) at $T_C$ = 100 °C | 6.5 | A |
| $I_{DM}$(1) | Drain current (pulsed) | 36 | A |
| $P_{TOT}$ | Total power dissipation at $T_C$ = 25 °C | 120 | W |
| $E_{AS}$(2) | Single pulse avalanche energy | 110 | mJ |
| dv/dt(3) | Drain-body diode dynamic dv/dt ruggedness | 5.8 | V/ns |
| $T_{stg}$ | Storage temperature range | -65 to 175 | °C |
| $T_J$ | Operating junction temperature range | | |

1. *Pulse width is limited by safe operating area.*
2. *Starting $T_J$ = 25 °C, $I_D$ = 4.5 A*
3. *$I_{SD}$ = 9 A, di/dt = 520 A/µs, $V_{DD}$ = 50 V, $T_J$ < $T_{Jmax}$*

**Table 2. Thermal data**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $R_{thj\text{-}case}$ | Thermal resistance junction-case | 1.26 | °C/W |
| $R_{thj\text{-}amb}$ | Thermal resistance junction-ambient | 62.5 | °C/W |

# 2 Electrical characteristics

$T_{CASE}$ = 25 °C unless otherwise specified

**Table 3. On/off states**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage | $V_{GS}$ = 0 V, $I_D$ = 250 µA | 200 | | | V |
| $I_{DSS}$ | Zero gate voltage drain current | $V_{GS}$ = 0 V, $V_{DS}$ = 200 V | | | 1 | µA |
| | | $V_{GS}$ = 0 V, $V_{DS}$ = 200 V, $T_C$ = 125 °C(1) | | | 100 | µA |
| $I_{GSS}$ | Gate body leakage current | $V_{DS}$ = 0 V, $V_{GS}$ = 20 V | | | ±100 | nA |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{DS}$ = $V_{GS}$, $I_D$ = 250 µA | 2 | 3 | 4 | V |
| $R_{DS(on)}$ | Static drain-source on-resistance | $V_{GS}$ = 10 V, $I_D$ = 4.5 A | | 0.29 | 0.40 | Ω |

1. *Defined by design, not subject to production test.*

**Table 4. Dynamic**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $C_{iss}$ | Input capacitance | $V_{DS}$ = 25 V, f = 1 MHz, $V_{GS}$ = 0 V | - | 370 | - | pF |
| $C_{oss}$ | Output capacitance | | - | 77 | - | pF |
| $C_{rss}$ | Reverse transfer capacitance | | - | 14 | - | pF |
| $Q_g$ | Total gate charge | $V_{DD}$ = 160 V, $I_D$ = 9 A $V_{GS}$ = 0 to 10 V (see Figure 13. Test circuit for gate charge behavior) | - | 11.6 | - | nC |
| $Q_{gs}$ | Gate-source charge | | - | 2.2 | - | nC |
| $Q_{gd}$ | Gate-drain charge | | - | 5.5 | - | nC |

**Table 5. Switching times**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_{d(on)}$ | Turn-on delay time | $V_{DD}$ = 100 V, $I_D$ = 4.5 A, $R_G$ = 4.7 Ω, $V_{GS}$ = 10 V (see Figure 12. Test circuit for resistive load switching times and Figure 17. Switching time waveform) | - | 5.6 | - | ns |
| $t_r$ | Rise time | | - | 2.6 | - | ns |

**Table 6. Source-drain diode**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{SD}$ (1) | Forward on voltage | $I_{SD}$ = 9 A, $V_{GS}$ = 0 V | - | | 1.5 | V |
| $t_{rr}$ | Reverse recovery time | $I_{SD}$ = 9 A, di/dt = 100 A/µs, $V_{DD}$ = 50 V (see Figure 17. Switching time waveform) | - | 118.5 | | ns |
| $Q_{rr}$ | Reverse recovery charge | | - | 393 | | nC |
| $I_{RRM}$ | Reverse recovery current | | - | 6.6 | | A |

1. *Pulsed: pulse duration = 300 µs, duty cycle 1.5%*

## 2.1 Electrical characteristics (curves)

**Figure 1. Safe operating area**

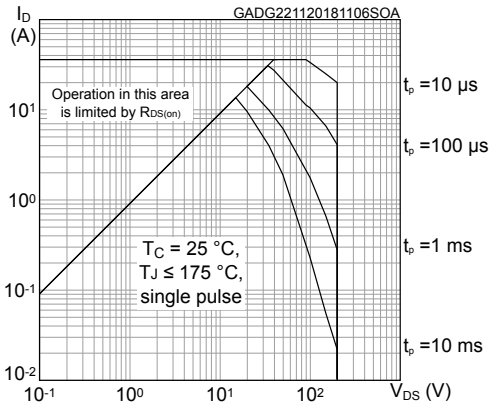



**Figure 2. Thermal impedance**

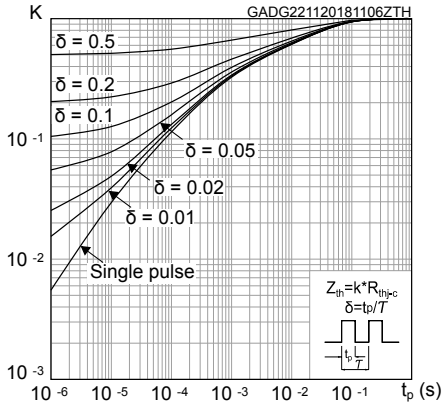



**Figure 3. Output characteristics**

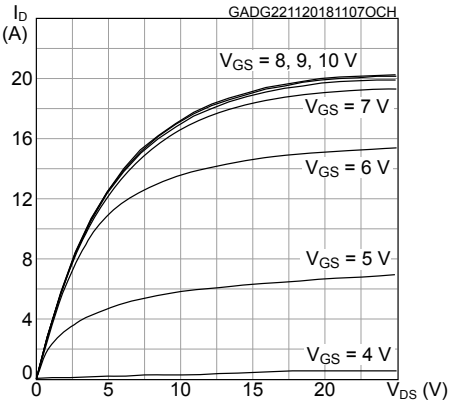



**Figure 4. Transfer characteristics**

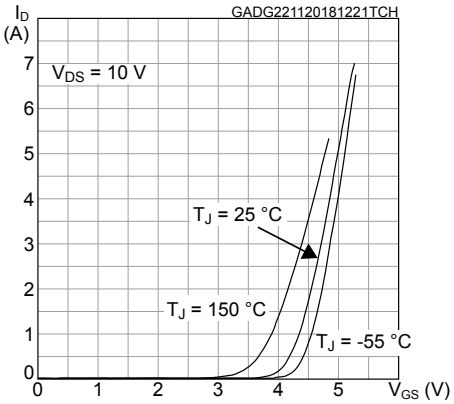



**Figure 5. Gate charge vs gate-source voltage**

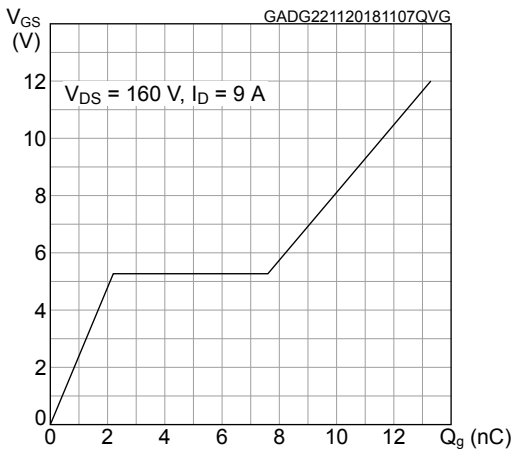



**Figure 6. Static drain-source on-resistance**

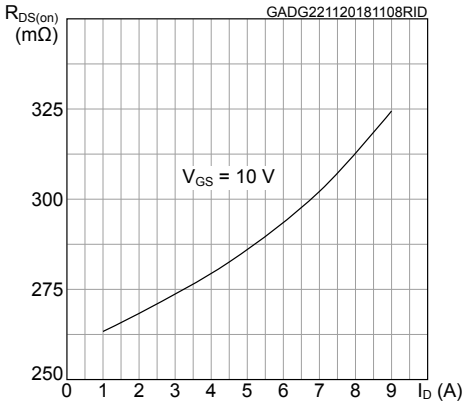


**Figure 7. Capacitance variations**

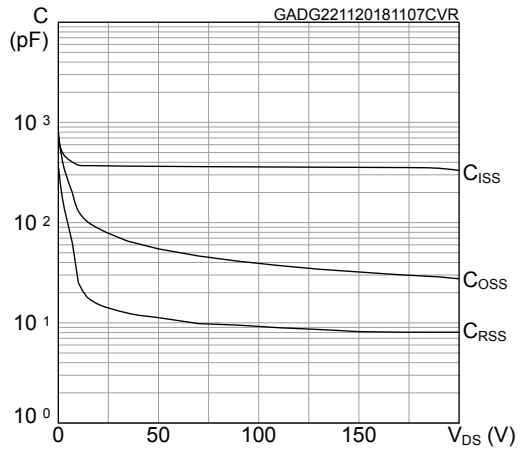



**Figure 8. Normalized gate threshold voltage vs temperature**

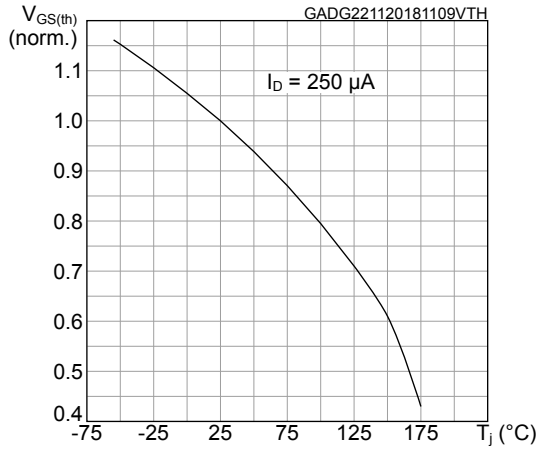



**Figure 9. Normalized on-resistance vs temperature**

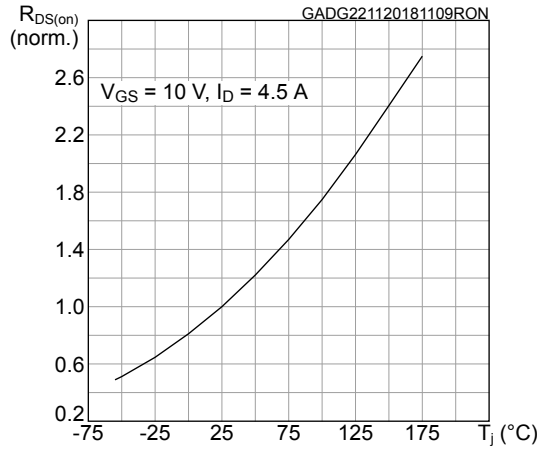



**Figure 10. Normalized $V_{(BR)DSS}$ vs temperature**

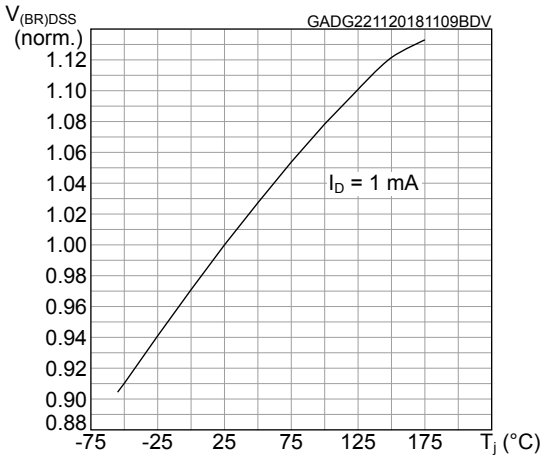
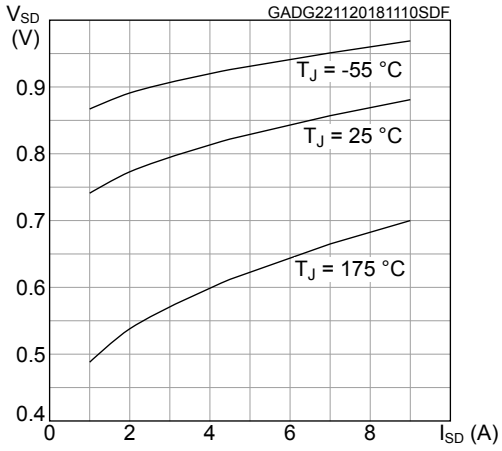



**Figure 11. Source-drain diode forward characteristics**



# 3 Test circuits

**Figure 12. Test circuit for resistive load switching times**

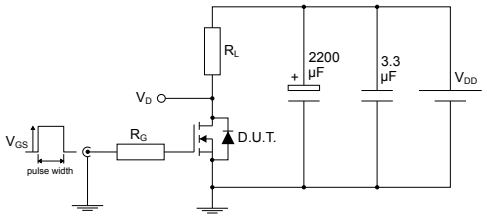



**Figure 13. Test circuit for gate charge behavior**

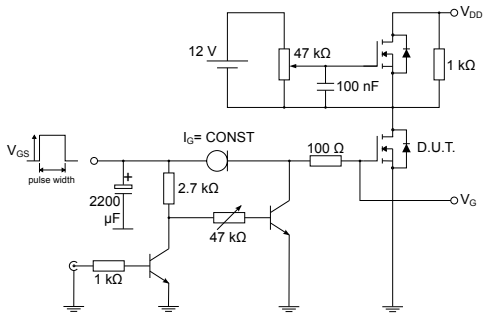



**Figure 14. Test circuit for inductive load switching and diode recovery times**

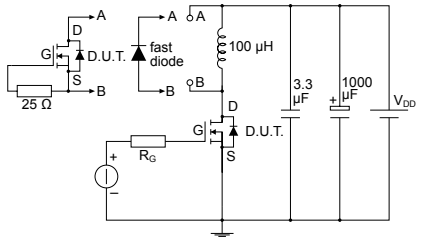



**Figure 15. Unclamped inductive load test circuit**

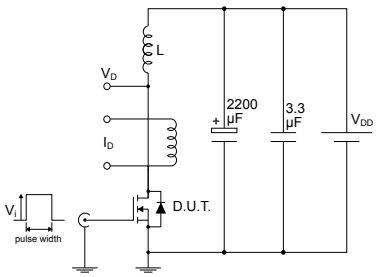



**Figure 16. Unclamped inductive waveform**

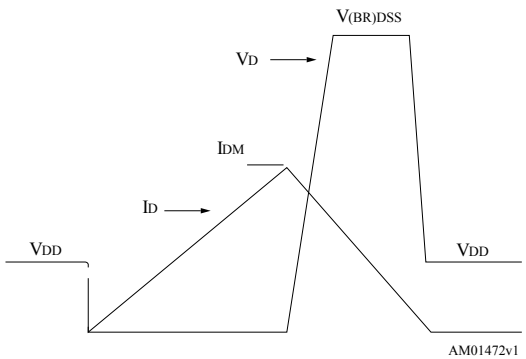
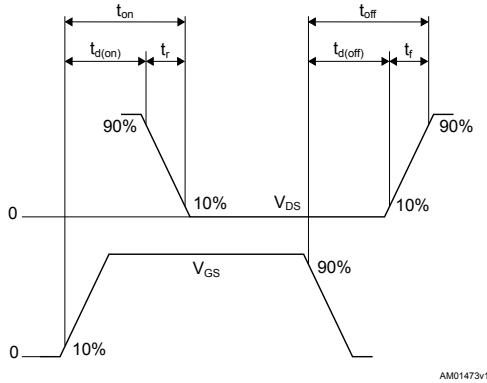



**Figure 17. Switching time waveform**



# 4 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK® is an ST trademark.

## 4.1 TO-220 type A package information

Figure 18. **TO-220 type A package outline**

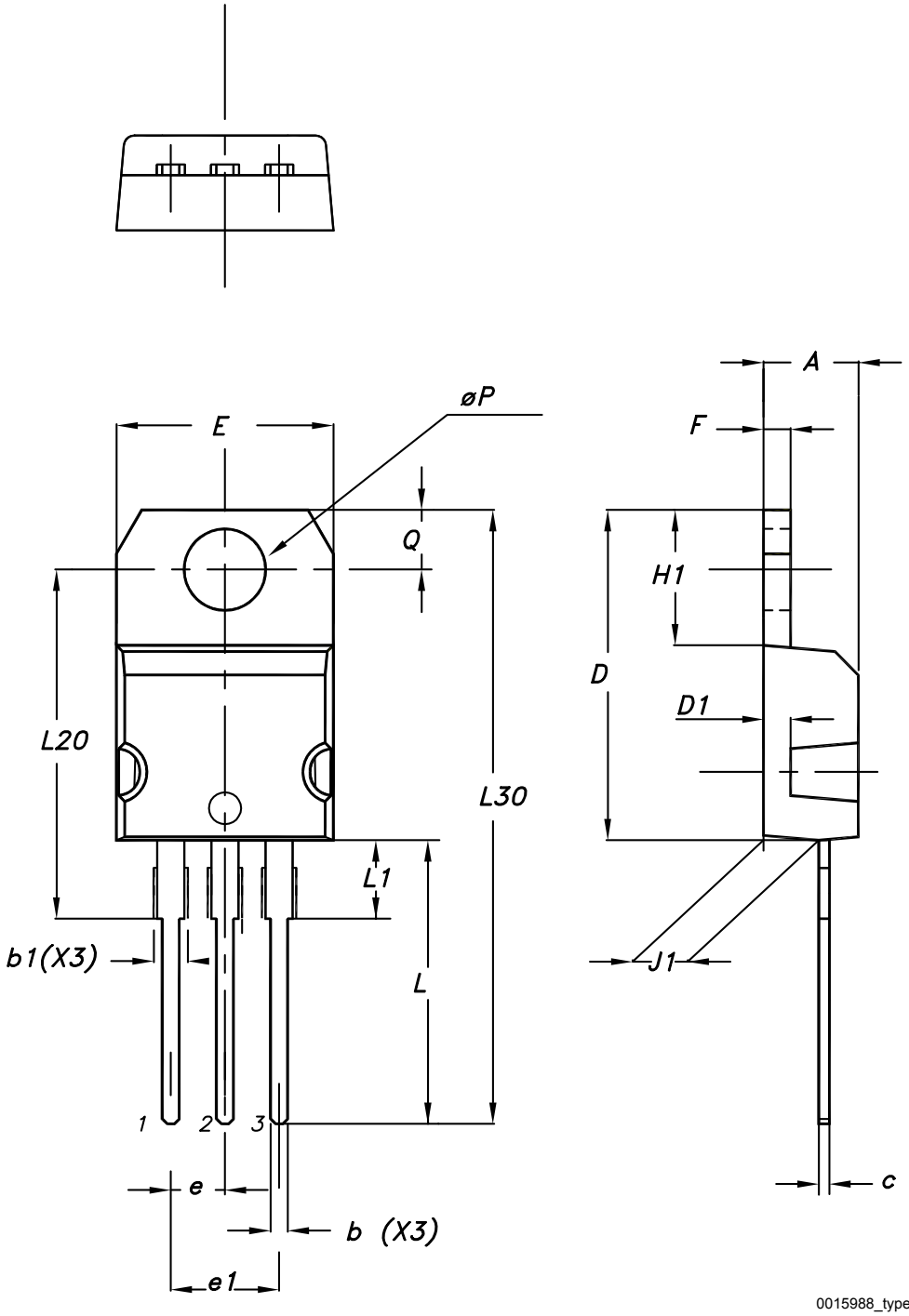


Table 7. **TO-220 type A package mechanical data**

| Dim. | mm | | |
|---|---|---|---|
| | Min. | Typ. | Max. |
| A | 4.40 | | 4.60 |
| b | 0.61 | | 0.88 |
| b1 | 1.14 | | 1.55 |
| c | 0.48 | | 0.70 |
| D | 15.25 | | 15.75 |
| D1 | | 1.27 | |
| E | 10.00 | | 10.40 |
| e | 2.40 | | 2.70 |
| e1 | 4.95 | | 5.15 |
| F | 1.23 | | 1.32 |
| H1 | 6.20 | | 6.60 |
| J1 | 2.40 | | 2.72 |
| L | 13.00 | | 14.00 |
| L1 | 3.50 | | 3.93 |
| L20 | | 16.40 | |
| L30 | | 28.90 | |
| øP | 3.75 | | 3.85 |
| Q | 2.65 | | 2.95 |

## Revision history

Table 8. **Document revision history**

| Date | Version | Changes |
|---|---|---|
| 09-Sep-2004 | 8 | Complete version |
| 03-Aug-2006 | 9 | New template, no content change |
| 12-Dec-2018 | 10 | Part number IRF630FP has been moved to a separate datasheet and the document has been updated accordingly.<br>Minor text changes |

# Contents

1 **Electrical ratings** . . . . . 2

2 **Electrical characteristics** . . . . . 3

2.1 Electrical characteristics (curves) . . . . . 5

3 **Test circuits** . . . . . 7

4 **Package information** . . . . . 8

4.1 TO-220 type A package information . . . . . 8

**Revision history** . . . . . 11