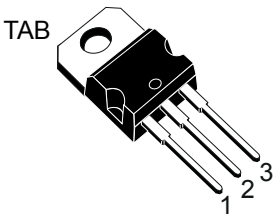
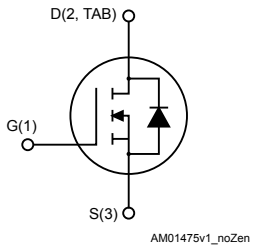
# N-channel 40 V, 1.7 mΩ typ., 160 A, STripFET™ F6 Power MOSFET in a TO-220 package




**TO-220**




| Product status |
|---|
| STP318N4F6 |

| Device summary | |
|---|---|
| **Order code** | STP318N4F6 |
| **Marking** | 318N4F6 |
| **Package** | TO-220 |
| **Packing** | Tube |

## Features

| Order code | $V_{DS}$ | $R_{DS(on)}$ max. | $I_D$ |
|---|---|---|---|
| STP318N4F6 | 40 V | 2.2 mΩ | 160 A |

- Very low on-resistance
- Very low gate charge
- High avalanche ruggedness
- Low gate drive power loss

## Applications

- Switching applications

## Description

This device is an N-channel Power MOSFET developed using the STripFET™ F6 technology with a new trench gate structure. The resulting Power MOSFET exhibits very low $R_{DS(on)}$ in all packages.

# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{DS}$ | Drain-source voltage | 40 | V |
| $V_{GS}$ | Gate-source voltage | ±20 | V |
| $I_D$ (1) | Drain current (continuous) at $T_C$ = 25 °C | 160 | A |
| $I_D$ (1) | Drain current (continuous) at $T_c$ = 100 °C | 160 | A |
| $I_{DM}$ (2) | Drain current (pulsed) | 640 | A |
| $P_{TOT}$ | Total dissipation at $T_C$ = 25 °C | 341 | W |
| $E_{AS}$ | Single pulse avalanche energy (starting $T_J$=25 °C, $I_D$=60 A, $V_{DD}$=35 V) | 1100 | mJ |
| $T_j$ | Operating junction temperature range | -55 to 175 | °C |
| $T_{stg}$ | Storage temperature range | | |

1. *Limited by wire bonding.*
2. *Pulse width limited by safe operating area.*

**Table 2. Thermal data**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $R_{thj\text{-}case}$ | Thermal resistance junction-case | 0.44 | °C/W |
| $R_{thj\text{-}amb}$ | Thermal resistance junction-amb | 62.5 | °C/W |

# 2 Electrical characteristics

($T_C$ = 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 | $I_D$ = 250 µA, $V_{GS}$ = 0 V | 40 | | | V |
| $I_{DSS}$ | Zero gate voltage drain current | $V_{GS}$ = 0 V, $V_{DS}$ = 40 V | | | 1 | µA |
| | | $V_{GS}$ = 0 V, $V_{DS}$ = 40 V, $T_C$=125 °C (1) | | | 100 | µA |
| $I_{GSS}$ | Gate-body leakage current | $V_{GS}$ = ±20 V, $V_{DS}$ = 0 V | | | 100 | nA |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{DS}$ = $V_{GS}$ , $I_D$ = 250 µA | 2 | | 4 | V |
| $R_{DS(on)}$ | Static drain-source on-resistance | $V_{GS}$ = 10 V, $I_D$= 80 A | | 1.7 | 2.2 | mΩ |

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 | - | 13800 | - | nF |
| $C_{oss}$ | Output capacitance | | - | 1870 | - | nF |
| $C_{rss}$ | Reverse transfer capacitance | | - | 1095 | - | nF |
| $Q_g$ | Total gate charge | $V_{DD}$ = 20 V, $I_D$ = 160 A, $V_{GS}$ = 0 to 10 V (see Figure 15. Test circuit for gate charge behavior) | - | 240 | - | nC |
| $Q_{gs}$ | Gate-source charge | | - | 59 | - | nC |
| $Q_{gd}$ | Gate-drain charge | | - | 75.2 | - | nC |

**Table 5. Switching times**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_{d(on)}$ | Turn-on delay time | $V_{DD}$ = 20 V, $I_D$ = 80 A, $R_G$ = 4.7 Ω, $V_{GS}$ = 10 V (see Figure 14. Test circuit for resistive load switching times and Figure 19. Switching time waveform) | - | 28 | - | ns |
| $t_r$ | Rise time | | - | 98 | - | ns |
| $t_{d(off)}$ | Turn-off delay time | | - | 190 | - | ns |
| $t_f$ | Fall time | | - | 95 | - | ns |

**Table 6. Source-drain diode**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{SD}$ (1) | Forward on-voltage | $I_{SD}$ = 160 A, $V_{GS}$ = 0 V | - | | 1.1 | V |

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_{rr}$ | Reverse recovery time | $I_{SD}$ = 160 A, di/dt = 100 A/µs | - | 58.7 | | ns |
| $Q_{rr}$ | Reverse recovery charge | $V_{DD}$ = 32 V, (see Figure 16. Test circuit for inductive load switching and diode recovery times) | - | 99.2 | | nC |
| $I_{RRM}$ | Reverse recovery current | | - | 3.38 | | A |

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

## 2.1 Electrical characteristics (curves)

**Figure 3. Safe operating area**

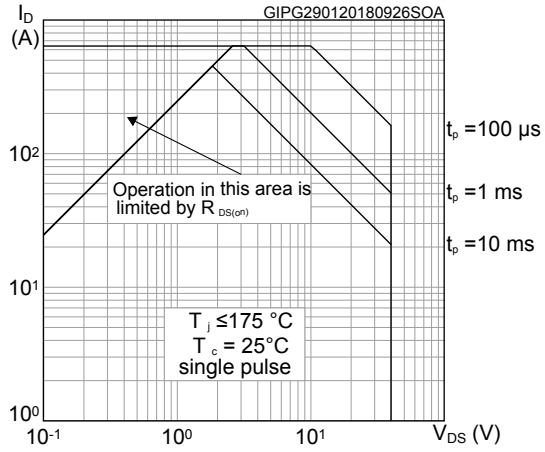



**Figure 4. Normalized thermal impedance**

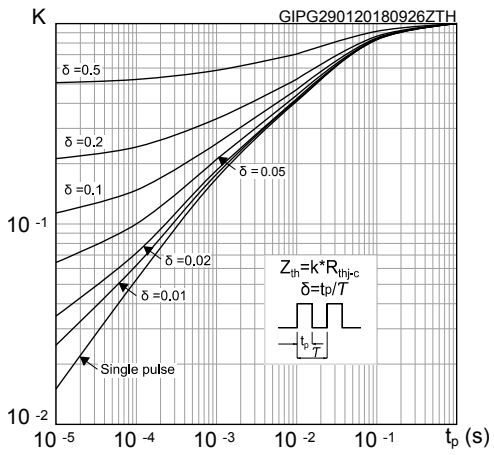



**Figure 5. Output characteristics**

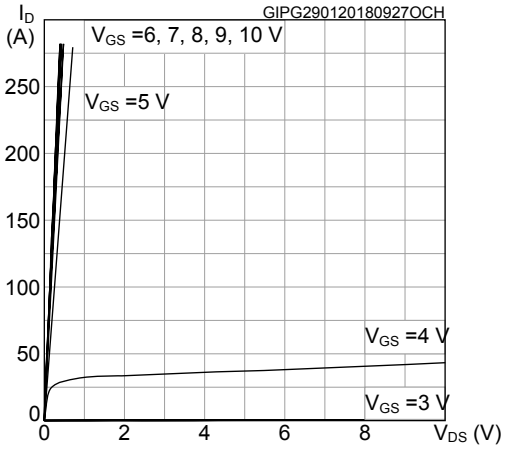



**Figure 6. Transfer characteristics**

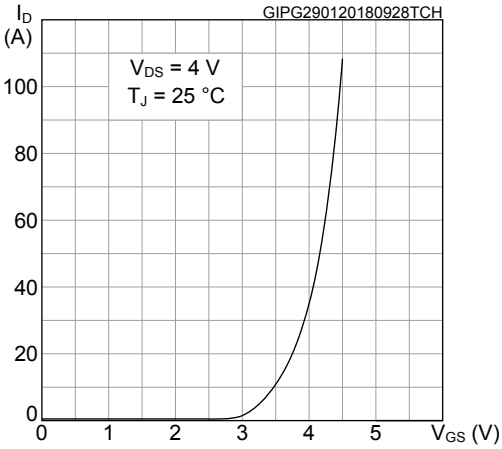



**Figure 7. Static drain-source on-resistance**

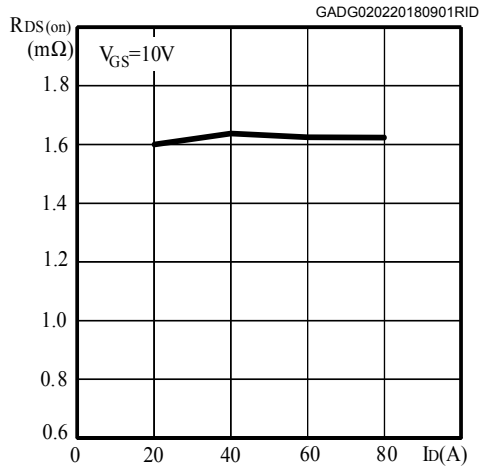



**Figure 8. Normalized $V_{(BR)DSS}$ vs. temperature**

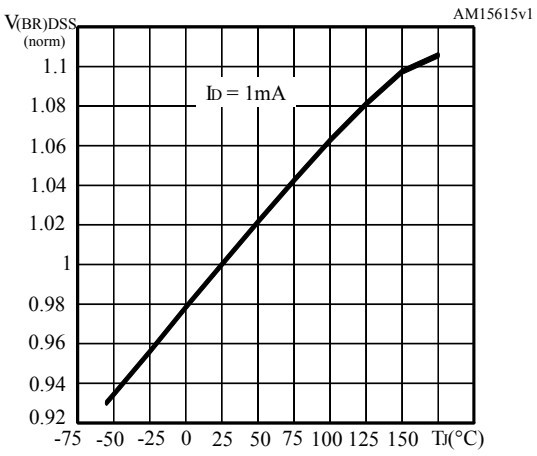


**Figure 9. Capacitance variations**

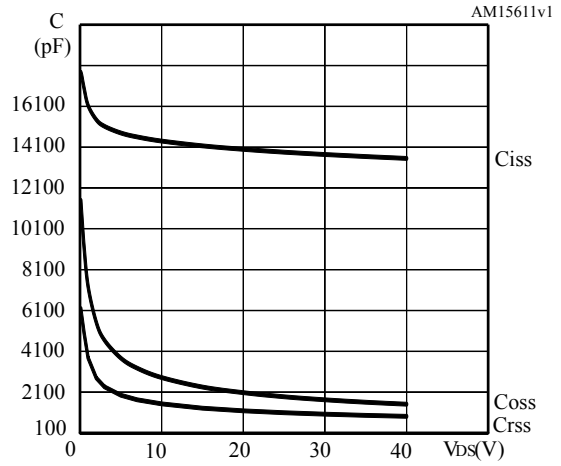



**Figure 10. Gate charge vs gate-source voltage**

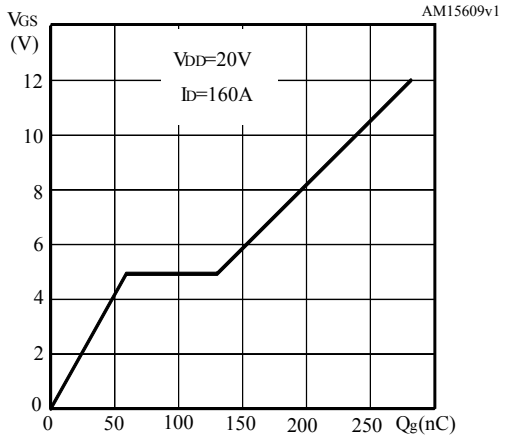



**Figure 11. Normalized $V_{GS(th)}$ vs. temperature**

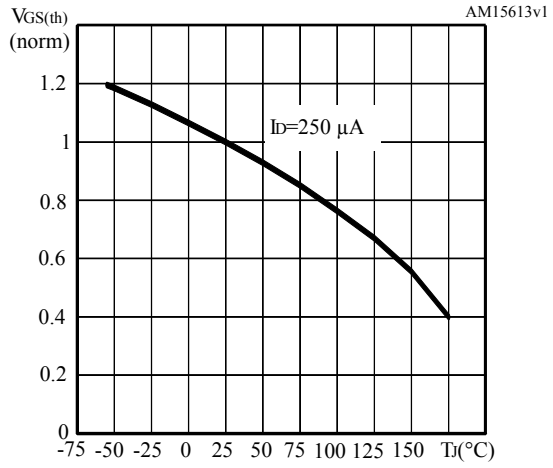



**Figure 12. Normalized $R_{DS(on)}$ vs. temperature**

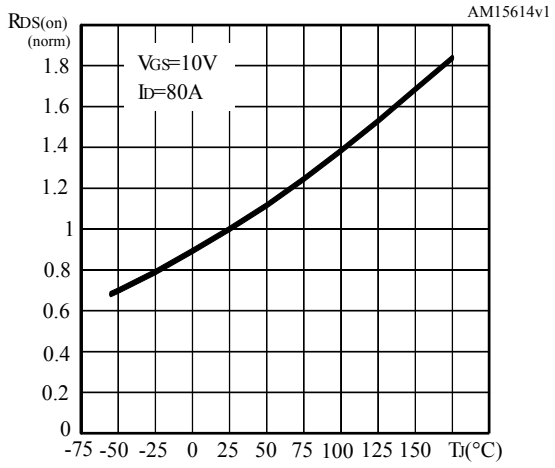
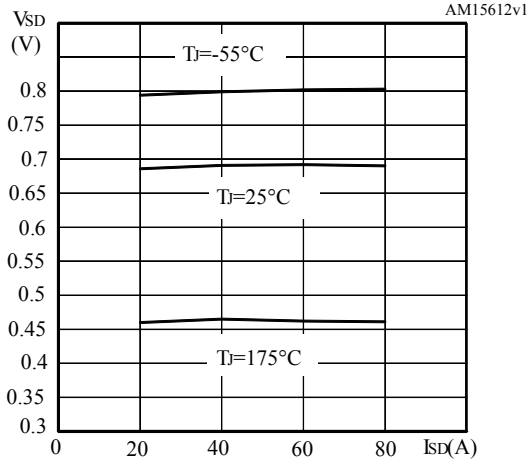



**Figure 13. Source-drain diode characteristics**



# 3 Test circuits

**Figure 14. Test circuit for resistive load switching times**

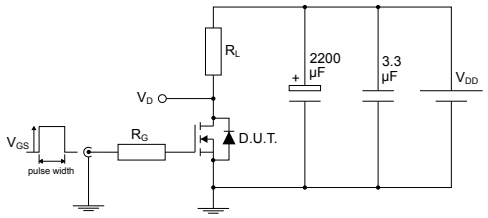



**Figure 15. Test circuit for gate charge behavior**

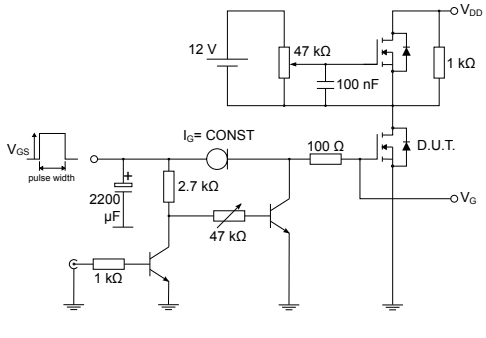



**Figure 16. Test circuit for inductive load switching and diode recovery times**

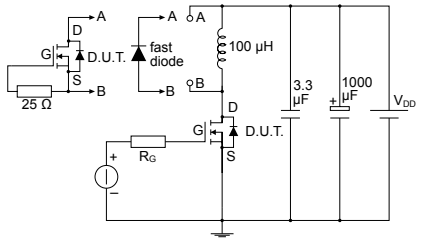



**Figure 17. Unclamped inductive load test circuit**

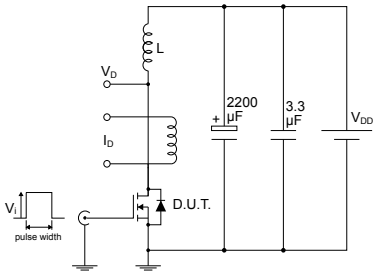



**Figure 18. Unclamped inductive waveform**

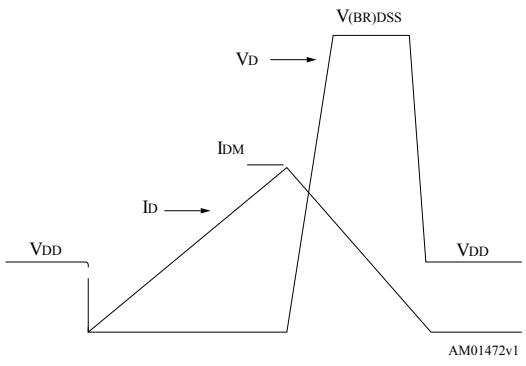
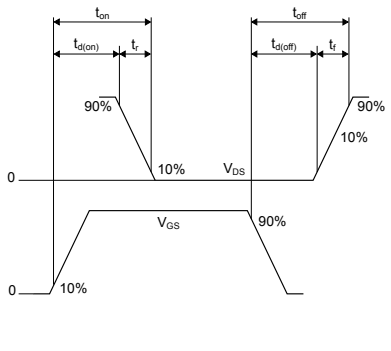



**Figure 19. Switching time waveform**

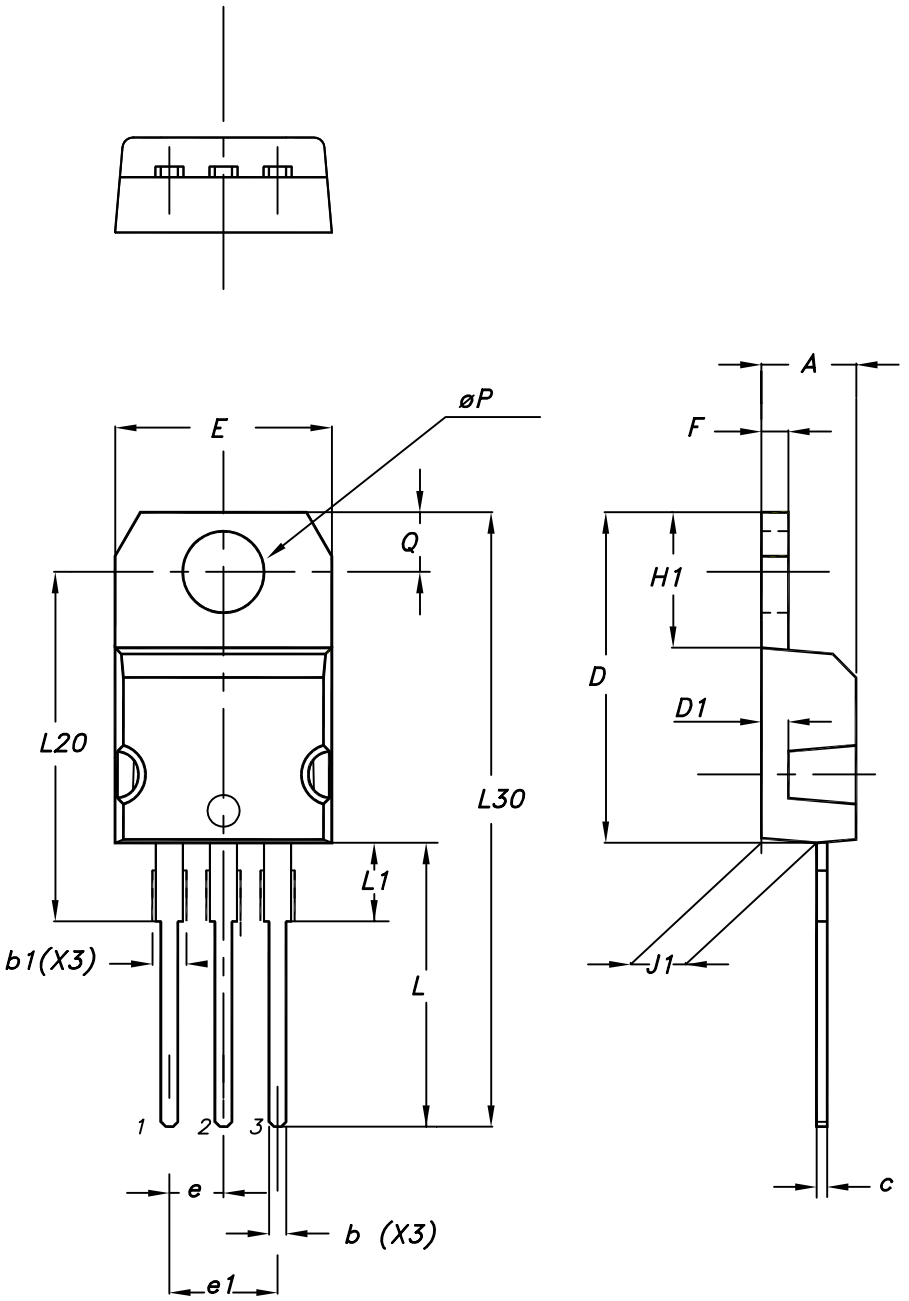


# 4 Package information

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 20. **TO-220 type A package outline**




0015988_typeA_Rev_21

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 |

# Contents

## Revision history

Table 8. **Document revision history**

| Date | Version | Changes |
|---|---|---|
| 08-Feb-2018 | 1 | Initial release.<br>Production data. |