# STP77N6F6

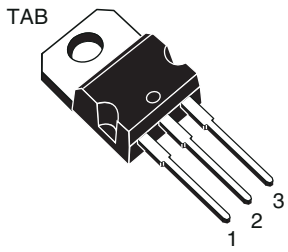
## N-channel 60 V, 6.6 mΩ typ., 77 A STripFET™ VI DeepGATE™ Power MOSFET in a TO-220 package

**Datasheet — production data**

## Features

| Order code | $V_{DS}$ | $R_{DS(on)}$ max | $I_D$ | $P_{TOT}$ |
|---|---|---|---|---|
| STP77N6F6 | 60 V | 7.9 mΩ ($V_{GS}$=10 V) | 77 A | 80 W |

- $R_{DS(on)}$ * $Q_g$ industry benchmark
- Extremely low on-resistance $R_{DS(on)}$
- High avalanche ruggedness
- Low gate drive power losses
- Very low switching gate charge




**TO-220**

## Applications

- Switching applications

## Description

This device is an N-channel Power MOSFET developed using the 6th generation of STripFET™ DeepGATE™ technology, with a new gate structure. The resulting Power MOSFET exhibits the lowest $R_{DS(on)}$ in all packages.

**Figure 1. Internal schematic diagram**

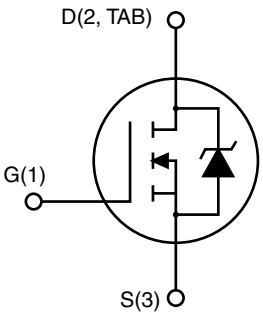



**Table 1. Device summary**

| Order code | Marking | Package | Packaging |
|---|---|---|---|
| STP77N6F6 | 77N6F6 | TO-220 | Tube |

# Contents

# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{DS}$ | Drain-source voltage | 60 | V |
| $V_{GS}$ | Gate-source voltage | ±20 | |
| $I_D$ (1) | Drain current (continuous) at $T_c$ = 25 °C | 77 | A |
| $I_D$ (1) | Drain current (continuous) at $T_c$ = 100 °C | 55 | |
| $I_{DM}$ (2) | Drain Current (pulsed) | 308 | |
| $P_{TOT}$ (1) | Total dissipation at $T_c$ = 25 °C | 80 | W |
| $T_{J\ Pstg}$ | Operating junction temperature<br>storage temperature | -55 to 175 | °C |

1. This value is rated according to Rthj-c
2. Pulse width is limited by safe operating area

**Table 3. Thermal data**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $R_{thj\text{-}c}$ | Thermal resistance junction-case | 1.88 | °C/W |
| $R_{thj\text{-}a}$ (1) | Thermal resistance junction-ambient | 62.5 | |

1. When mounted on FR-4 board of 1 inch², 2 oz Cu, t < 10 sec

**Table 4. Avalache characteristics**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $I_{AR}$ | Avalanche current, repetitive or not-repetitive (pulse width limited by maximum junction temperature) | TBD | A |
| $E_{AS}$ | Single pulse avalanche energy ($T_J$ = 25 °C, $I_D$ = $I_{AR}$, $V_{DD}$ = 14 V) | TBD | mJ |

# 2 Electrical characteristics

($T_J$= 25 °C unless otherwise specified)

**Table 5. On/off states**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage ($V_{GS}$ = 0) | $I_D$ = 250 µA | 60 | | | V |
| $I_{DSS}$ | Zero gate voltage Drain current ($V_{GS}$ = 0) | $V_{DS}$ = 60 V<br>$V_{DS}$ = 60 V, $T_J$=125 °C | | | 10<br>100 | µA<br>µA |
| $I_{GSS}$ | Gate-body leakage current ($V_{DS}$ = 0) | $V_{GS}$ = ± 20 V | | | ± 100 | V |
| $V_{GS(th)}$ | 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, $I_D$ = 33 A | | 6.6 | 7.9 | Ω |

**Table 6. Dynamic**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $C_{iss}$ | Input capacitance | $V_{DS}$ = 25 V, f = 1 MHz, $V_{GS}$ = 0 | - | 5300 | - | pF |
| $C_{oss}$ | Output capacitance | | | 1290 | | |
| $C_{rss}$ | Reverse transfer capacitance | | | 217 | | |
| $Q_g$ | Total gate charge | $V_{DD}$ = 30 V, $I_D$ = 77 A, $V_{GS}$ = 10 V | - | 76 | - | nC |
| $Q_{gs}$ | Gate-source charge | | | TBD | | |
| $Q_{gd}$ | Gate-drain charge | | | TBD | | |
| $R_g$ | Intrinsic gate resistance | f = 1 MHz open drain | - | 3.6 | - | Ω |

**Table 7. Switching times**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_{d(on)}$<br>$t_r$ | Turn-on delay time<br>Rise time | $V_{DD}$ = 30 V, $I_D$ = 33A<br>$R_G$ = 4.7 Ω $V_{GS}$ = 10 V | - | TBD | - | ns |
| $t_{d(off)}$<br>$t_f$ | Turn-off-delay time<br>Fall time | | - | | - | |

**Table 8. Source drain diode**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_{SD}$ | Source-drain current | | - | | 77 | A |
| $I_{SDM}$ (1) | Source-drain current (pulsed) | | - | | 308 | A |
| $V_{SD}$ (2) | Forward on voltage | $I_{SD}$ = 77 A, $V_{GS}$ = 0 | - | | | V |
| $t_{rr}$<br>$Q_{rr}$<br>$I_{RRM}$ | Reverse recovery time<br>Reverse recovery charge<br>Reverse recovery current | $I_{SD}$ = 77 A, $V_{DD}$ = 80 V<br>di/dt = 100 A/µs,<br>$T_j$ = 150 °C | - | TBD | TBD | ns<br>nC<br>A |

1. Pulse width is limited by safe operating area
2. Pulse test: pulse duration = 300 µs, duty cycle 1.5%

# 3 Test circuits

**Figure 2. Switching times test circuit for resistive load**

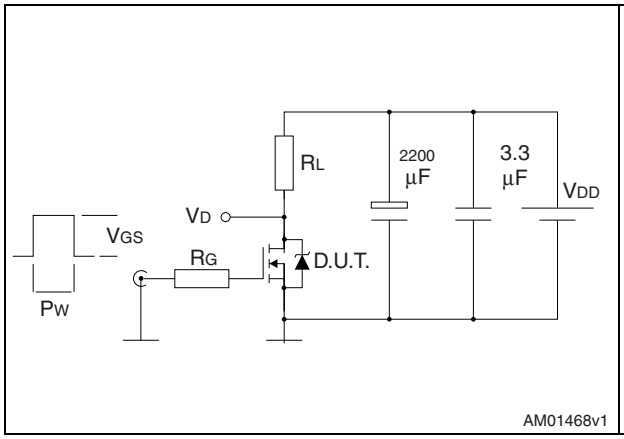



**Figure 3. Gate charge test circuit**

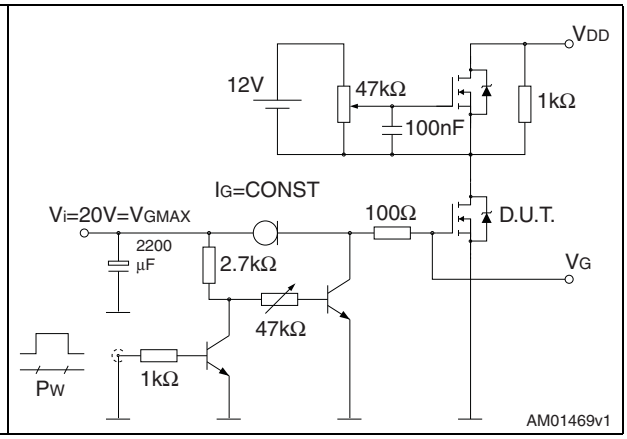



**Figure 4. Test circuit for inductive load switching and diode recovery times**

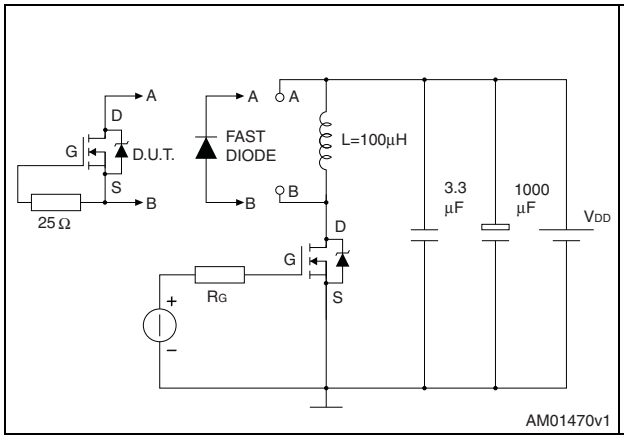



**Figure 5. Unclamped inductive load test circuit**

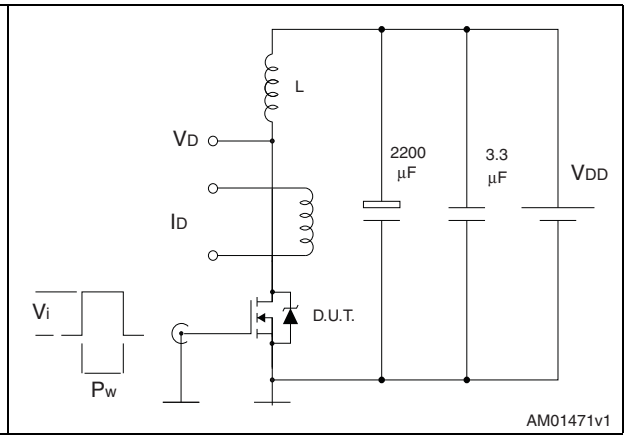



**Figure 6. Unclamped inductive waveform**

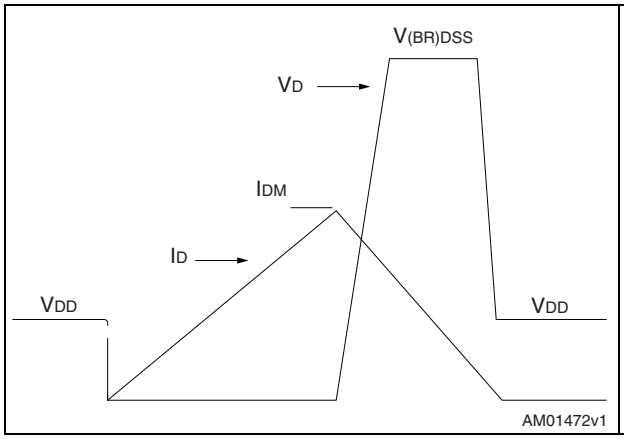
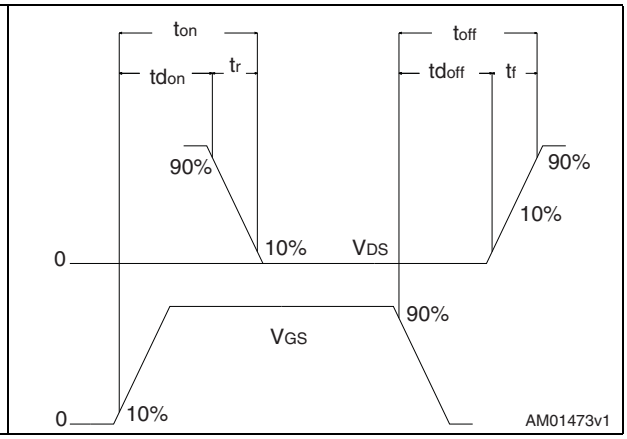



**Figure 7. Switching time waveform**



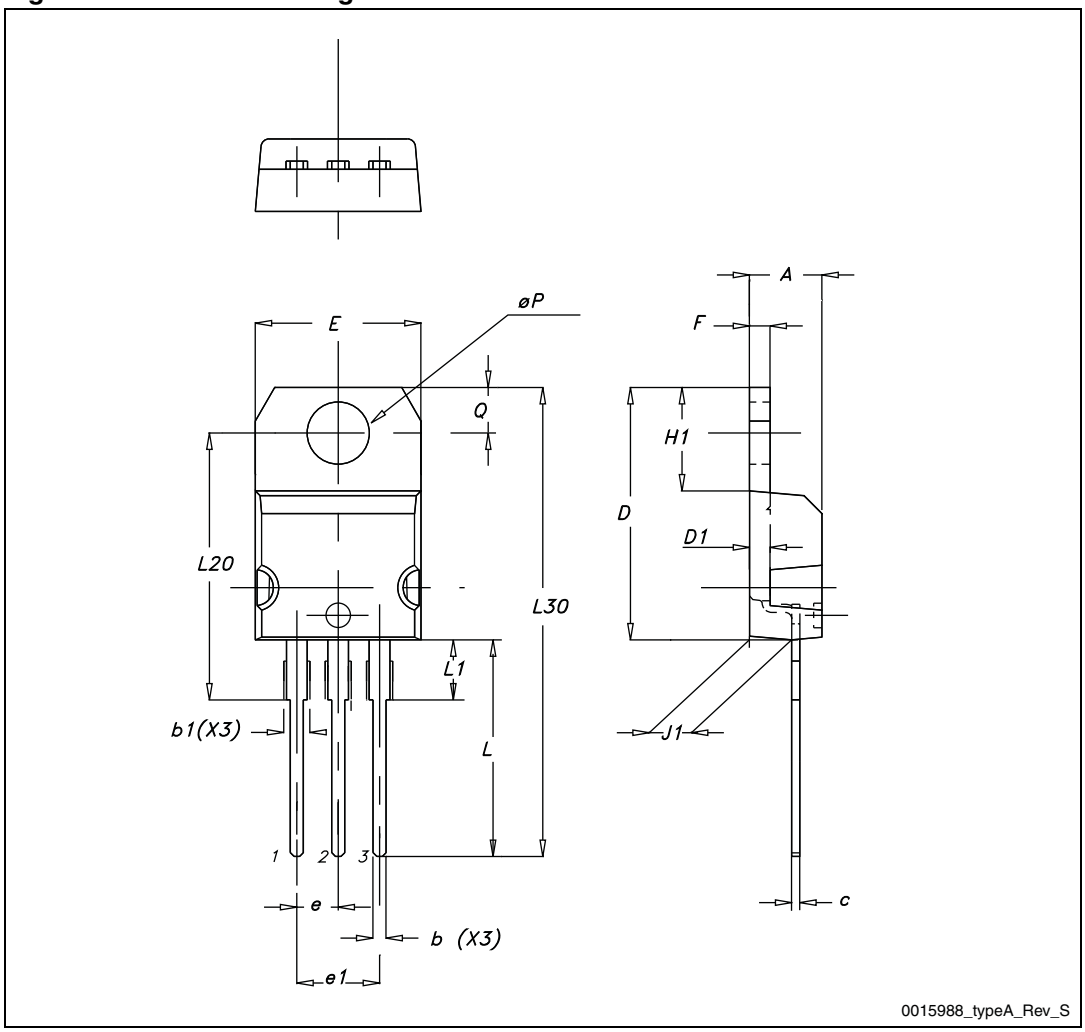
# 4 Package mechanical data

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.

**Table 9. TO-220 type A mechanical data**

| Dim. | mm | | |
|---|---|---|---|
| | Min. | Typ. | Max. |
| A | 4.40 | | 4.60 |
| b | 0.61 | | 0.88 |
| b1 | 1.14 | | 1.70 |
| c | 0.48 | | 0.70 |
| D | 15.25 | | 15.75 |
| D1 | | 1.27 | |
| E | 10 | | 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 | | 14 |
| L1 | 3.50 | | 3.93 |
| L20 | | 16.40 | |
| L30 | | 28.90 | |
| ∅P | 3.75 | | 3.85 |
| Q | 2.65 | | 2.95 |

**Figure 8. TO-220 drawing**



# 5 Revision history

Table 10. Document revision history

| Date | Revision | Changes |
|---|---|---|
| 12-Dec-2012 | 1 | First release. |