



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

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.

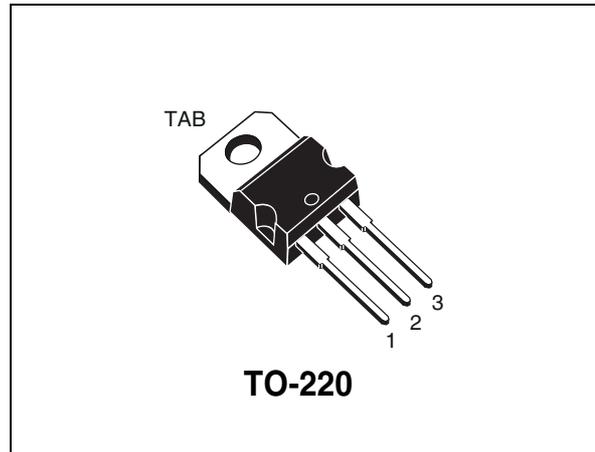


Figure 1. Internal schematic diagram

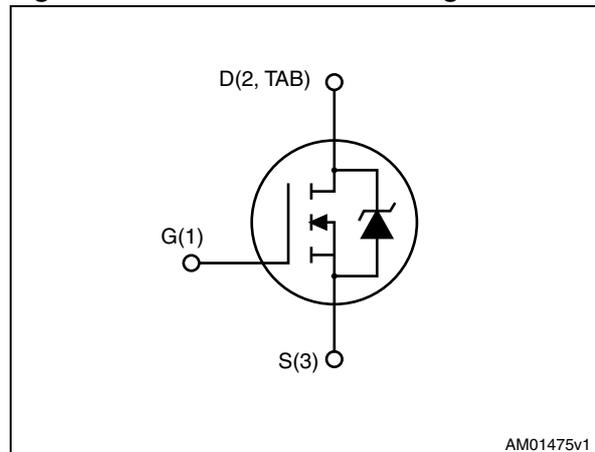


Table 1. Device summary

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

Contents

| | | |
|---|---|---|
| 1 | Electrical ratings | 3 |
| 2 | Electrical characteristics | 4 |
| 3 | Test circuits | 6 |
| 4 | Package mechanical data | 7 |
| 5 | Revision history | 9 |

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 $T_c = 25\text{ }^\circ\text{C}$ | 77 | A |
| $I_D^{(1)}$ | Drain current (continuous) at $T_c = 100\text{ }^\circ\text{C}$ | 55 | |
| $I_{DM}^{(2)}$ | Drain Current (pulsed) | 308 | |
| $P_{TOT}^{(1)}$ | Total dissipation at $T_c = 25\text{ }^\circ\text{C}$ | 80 | W |
| T_{JPstg} | Operating junction temperature storage temperature | -55 to 175 | $^\circ\text{C}$ |

1. This value is rated according to R_{thj-c}
2. Pulse width is limited by safe operating area

Table 3. Thermal data

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

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

Table 4. Avalanche 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 ($T_J = 25\text{ }^\circ\text{C}$, $I_D = I_{AR}$, $V_{DD} = 14\text{ V}$) | TBD | mJ |

2 Electrical characteristics

($T_J = 25\text{ °C}$ unless otherwise specified)

Table 5. On/off states

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---------------|--|---|------|------|-----------|--------------------------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage ($V_{GS} = 0$) | $I_D = 250\ \mu\text{A}$ | 60 | | | V |
| I_{DSS} | Zero gate voltage Drain current ($V_{GS} = 0$) | $V_{DS} = 60\ \text{V}$ $V_{DS} = 60\ \text{V}, T_J = 125\text{ °C}$ | | | 10 100 | μA μA |
| I_{GSS} | Gate-body leakage current ($V_{DS} = 0$) | $V_{GS} = \pm 20\ \text{V}$ | | | ± 100 | V |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$ | 2 | | 4 | V |
| $R_{DS(on)}$ | Static drain-source on-resistance | $V_{GS} = 10\ \text{V}, I_D = 33\ \text{A}$ | | 6.6 | 7.9 | Ω |

Table 6. Dynamic

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

Table 7. Switching times

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|--------------|---------------------|---|------|------|------|------|
| $t_{d(on)}$ | Turn-on delay time | | - | | - | |
| t_r | Rise time | $V_{DD} = 30\ \text{V}, I_D = 33\ \text{A}$ $R_G = 4.7\ \Omega, V_{GS} = 10\ \text{V}$ | | TBD | | ns |
| $t_{d(off)}$ | Turn-off-delay time | | - | | - | |
| t_f | 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 | |
| $V_{SD}^{(2)}$ | Forward on voltage | $I_{SD} = 77 \text{ A}, V_{GS} = 0$ | - | | | V |
| t_{rr} | Reverse recovery time | $I_{SD} = 77 \text{ A}, V_{DD} = 80 \text{ V}$ $di/dt = 100 \text{ A}/\mu\text{s},$ $T_j = 150 \text{ }^\circ\text{C}$ | - | TBD | TBD | ns |
| Q_{rr} | Reverse recovery charge | | | | | nC |
| I_{RRM} | Reverse recovery current | | | | | 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

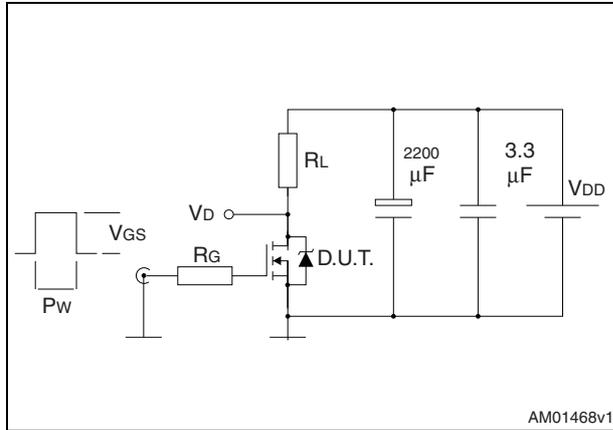


Figure 3. Gate charge test circuit

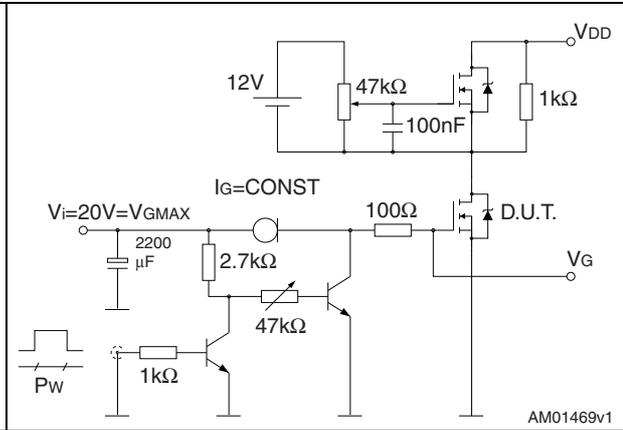


Figure 4. Test circuit for inductive load switching and diode recovery times

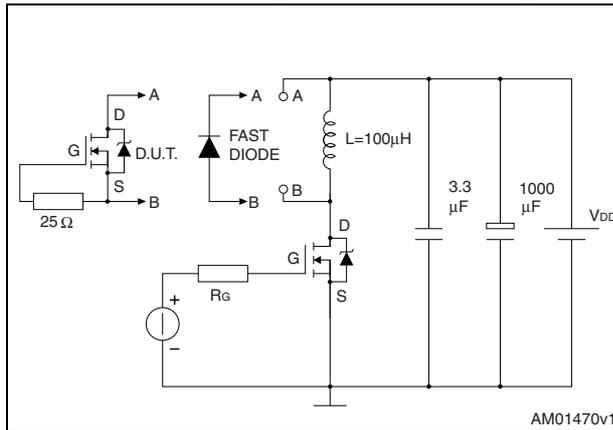


Figure 5. Unclamped inductive load test circuit

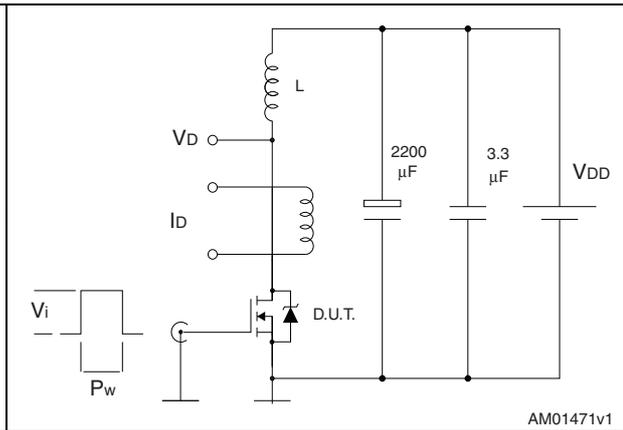


Figure 6. Unclamped inductive waveform

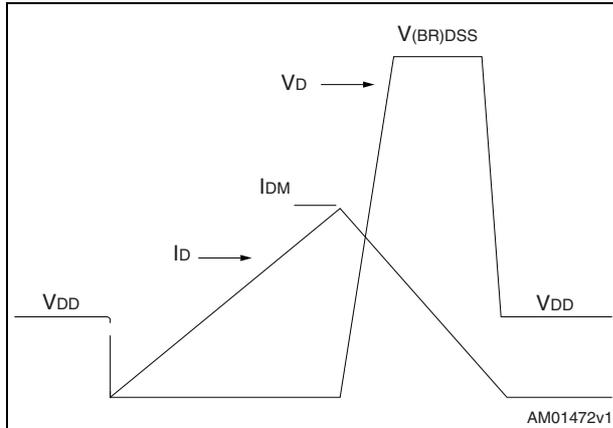
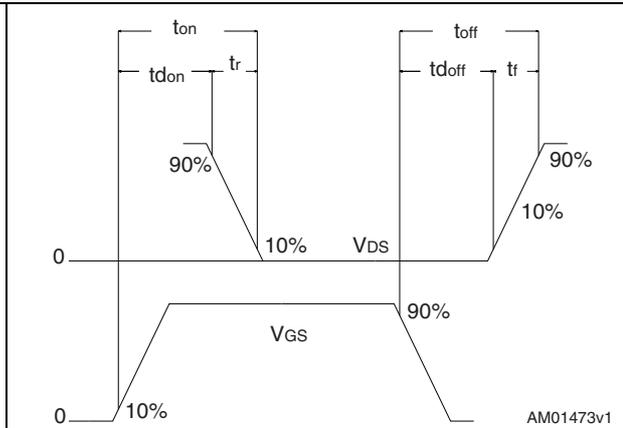


Figure 7. Switching time waveform



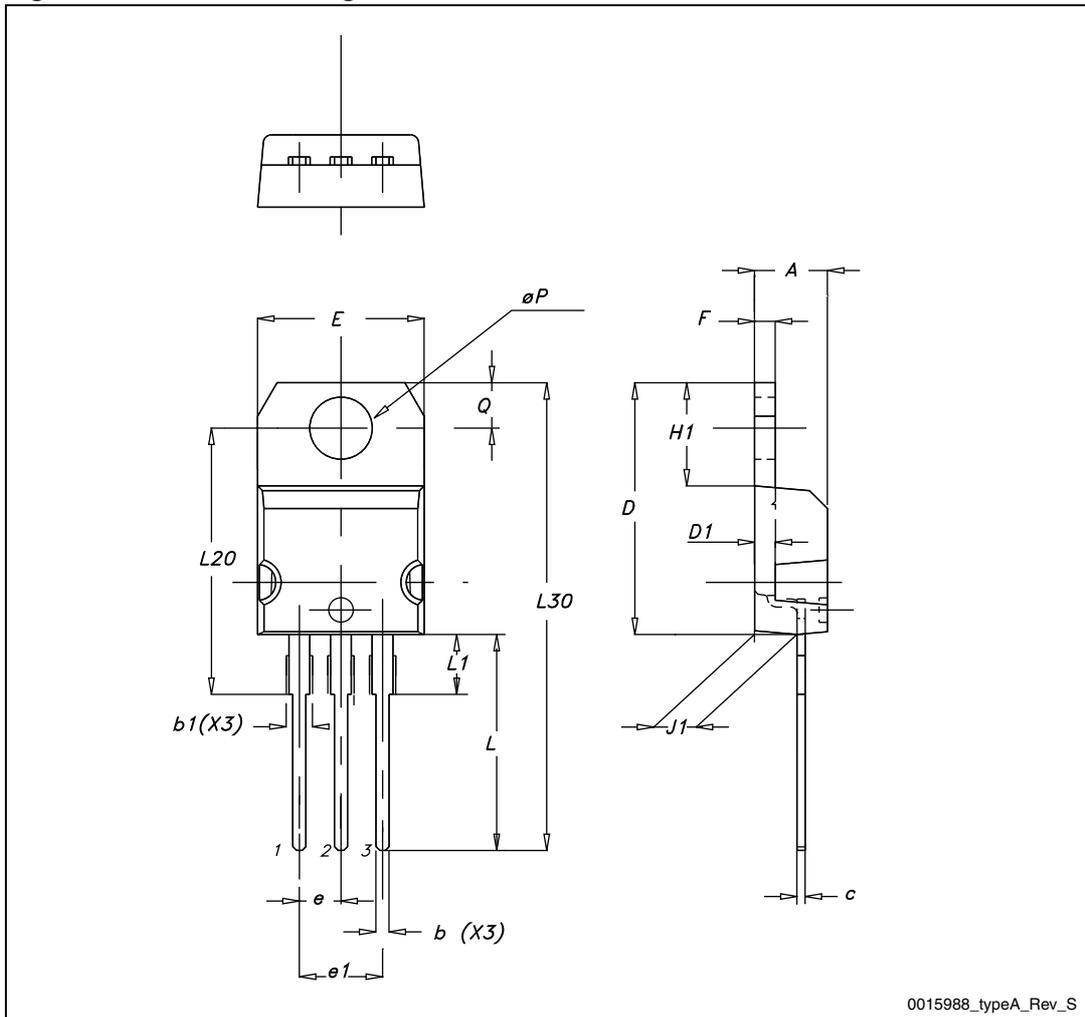
4 Package mechanical data

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 | |
| ØP | 3.75 | | 3.85 |
| Q | 2.65 | | 2.95 |

Figure 8. TO-220 drawing



0015988_typeA_Rev_S

5 Revision history

Table 10. Document revision history

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

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