



## STP45NF06

N-CHANNEL 60V - 0.022Ω - 38A TO-220

STripFET™ POWER MOSFET

PRELIMINARY DATA

| TYPE      | V <sub>DSS</sub> | R <sub>DS(on)</sub> | I <sub>D</sub> |
|-----------|------------------|---------------------|----------------|
| STP45NF06 | 60V              | <0.028Ω             | 38A            |

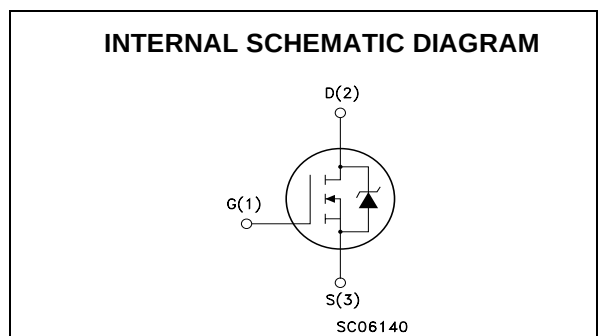
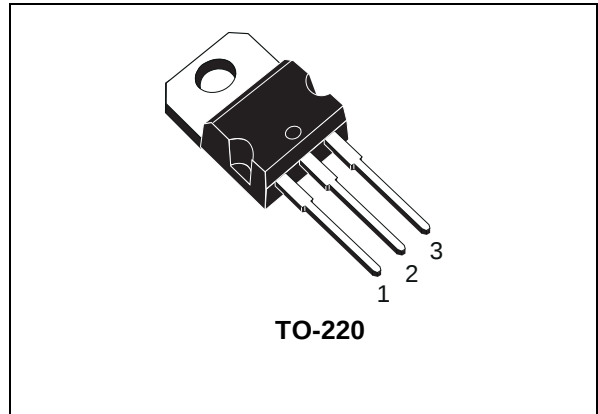
- TYPICAL R<sub>DS(on)</sub> = 0.022Ω
- EXCEPTIONAL dv/dt CAPABILITY

### DESCRIPTION

This Power Mosfet is the latest development of STMicroelectronics unique "Single Feature Size™" strip-based process. The resulting transistor shows extremely high packing density for low on-resistance, rugged avalanche characteristics and less critical alignment steps therefore a remarkable manufacturing reproducibility.

### APPLICATIONS

- HIGH-EFFICIENCY DC-DC CONVERTERS
- SOLENOID AND RELAY DRIVERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- DC-DC & DC-AC CONVERTERS



### ABSOLUTE MAXIMUM RATINGS

| Symbol              | Parameter                                            | Value      | Unit |
|---------------------|------------------------------------------------------|------------|------|
| V <sub>DS</sub>     | Drain-source Voltage (V <sub>GS</sub> = 0)           | 60         | V    |
| V <sub>DGR</sub>    | Drain-gate Voltage (R <sub>GS</sub> = 20 kΩ)         | 60         | V    |
| V <sub>GS</sub>     | Gate- source Voltage                                 | ±20        | V    |
| I <sub>D</sub>      | Drain Current (continuous) at T <sub>C</sub> = 25°C  | 38         | A    |
| I <sub>D</sub>      | Drain Current (continuous) at T <sub>C</sub> = 100°C | 26         | A    |
| I <sub>DM</sub> (●) | Drain Current (pulsed)                               | 152        | A    |
| P <sub>TOT</sub>    | Total Dissipation at T <sub>C</sub> = 25°C           | 80         | W    |
|                     | Derating Factor                                      | 0.53       | W/°C |
| dv/dt (1)           | Peak Diode Recovery voltage slope                    | 7          | V/ns |
| T <sub>stg</sub>    | Storage Temperature                                  | -65 to 175 | °C   |
| T <sub>j</sub>      | Max. Operating Junction Temperature                  | 175        | °C   |

(●) Pulse width limited by safe operating area

(1) I<sub>SD</sub> ≤ 38A, di/dt ≤ 300A/μs, V<sub>DD</sub> ≤ V<sub>(BR)DSS</sub>, T<sub>j</sub> ≤ T<sub>JMAX</sub>.

## THERMAL DATA

|                |                                                |      |      |
|----------------|------------------------------------------------|------|------|
| Rthj-case      | Thermal Resistance Junction-case Max           | 1.87 | °C/W |
| Rthj-amb       | Thermal Resistance Junction-ambient Max        | 62.5 | °C/W |
| T <sub>l</sub> | Maximum Lead Temperature For Soldering Purpose | 300  | °C   |

## AVALANCHE CHARACTERISTICS

| Symbol          | Parameter                                                                                                                  | Max Value | Unit |
|-----------------|----------------------------------------------------------------------------------------------------------------------------|-----------|------|
| I <sub>AR</sub> | Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T <sub>j</sub> max)                                | 38        | A    |
| E <sub>AS</sub> | Single Pulse Avalanche Energy (starting T <sub>j</sub> = 25 °C, I <sub>D</sub> = I <sub>AR</sub> , V <sub>DD</sub> = 50 V) | 135       | mJ   |

ELECTRICAL CHARACTERISTICS (TCASE = 25 °C UNLESS OTHERWISE SPECIFIED)  
OFF

| Symbol               | Parameter                                             | Test Conditions                                                                       | Min. | Typ. | Max.    | Unit     |
|----------------------|-------------------------------------------------------|---------------------------------------------------------------------------------------|------|------|---------|----------|
| V <sub>(BR)DSS</sub> | Drain-source Breakdown Voltage                        | I <sub>D</sub> = 250 µA, V <sub>GS</sub> = 0                                          | 60   |      |         | V        |
| I <sub>DSS</sub>     | Zero Gate Voltage Drain Current (V <sub>GS</sub> = 0) | V <sub>DS</sub> = Max Rating<br>V <sub>DS</sub> = Max Rating, T <sub>C</sub> = 125 °C |      |      | 1<br>10 | µA<br>µA |
| I <sub>GSS</sub>     | Gate-body Leakage Current (V <sub>DS</sub> = 0)       | V <sub>GS</sub> = ±20V                                                                |      |      | ±100    | nA       |

## ON (1)

| Symbol              | Parameter                         | Test Conditions                                                                          | Min. | Typ.  | Max.  | Unit |
|---------------------|-----------------------------------|------------------------------------------------------------------------------------------|------|-------|-------|------|
| V <sub>GS(th)</sub> | Gate Threshold Voltage            | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250µA                               | 2    | 3     | 4     | V    |
| R <sub>DS(on)</sub> | Static Drain-source On Resistance | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 19 A                                            |      | 0.022 | 0.028 | Ω    |
| I <sub>D(on)</sub>  | On State Drain Current            | V <sub>DS</sub> > I <sub>D(on)</sub> × R <sub>DS(on)</sub> max,<br>V <sub>GS</sub> = 10V | 45   |       |       | A    |

## DYNAMIC

| Symbol              | Parameter                    | Test Conditions                                                                          | Min. | Typ. | Max. | Unit |
|---------------------|------------------------------|------------------------------------------------------------------------------------------|------|------|------|------|
| g <sub>fs</sub> (1) | Forward Transconductance     | V <sub>DS</sub> > I <sub>D(on)</sub> × R <sub>DS(on)</sub> max,<br>I <sub>D</sub> = 19 A |      | 24   |      | S    |
| C <sub>iss</sub>    | Input Capacitance            | V <sub>DS</sub> = 25V, f = 1 MHz, V <sub>GS</sub> = 0                                    |      | 1730 |      | pF   |
| C <sub>oss</sub>    | Output Capacitance           |                                                                                          |      | 215  |      | pF   |
| C <sub>rss</sub>    | Reverse Transfer Capacitance |                                                                                          |      | 63   |      | pF   |

**ELECTRICAL CHARACTERISTICS (CONTINUED)****SWITCHING ON**

| Symbol      | Parameter          | Test Conditions                                                    | Min. | Typ. | Max. | Unit |
|-------------|--------------------|--------------------------------------------------------------------|------|------|------|------|
| $t_{d(on)}$ | Turn-on Delay Time | $V_{DD} = 30V$ , $I_D = 19A$                                       |      | 20   |      | ns   |
| $t_r$       | Rise Time          | $R_G = 4.7\Omega$ , $V_{GS} = 10V$<br>(see test circuit, Figure 3) |      | 100  |      | ns   |
| $Q_g$       | Total Gate Charge  | $V_{DD} = 48V$ , $I_D = 38A$ ,<br>$V_{GS} = 10V$                   |      | 43   | 58   | nC   |
| $Q_{gs}$    | Gate-Source Charge |                                                                    |      | 9    |      | nC   |
| $Q_{gd}$    | Gate-Drain Charge  |                                                                    |      | 15   |      | nC   |

**SWITCHING OFF**

| Symbol       | Parameter             | Test Conditions                                                                                      | Min. | Typ. | Max. | Unit |
|--------------|-----------------------|------------------------------------------------------------------------------------------------------|------|------|------|------|
| $t_{d(off)}$ | Turn-off-Delay Time   | $V_{DD} = 30V$ , $I_D = 19A$ ,<br>$R_G = 4.7\Omega$ , $V_{GS} = 10V$<br>(see test circuit, Figure 3) |      | 50   |      | ns   |
| $t_f$        | Fall Time             |                                                                                                      |      | 20   |      | ns   |
| $t_{d(off)}$ | Off-voltage Rise Time | $V_{clamp} = 48V$ , $I_D = 38A$ ,<br>$R_G = 4.7\Omega$ , $V_{GS} = 10V$                              |      | 45   |      | ns   |
| $t_f$        | Fall Time             | (see test circuit, Figure 5)                                                                         |      | 42   |      | ns   |
| $t_c$        | Cross-over Time       |                                                                                                      |      | 60   |      | ns   |

**SOURCE DRAIN DIODE**

| Symbol        | Parameter                     | Test Conditions                                                                                                  | Min. | Typ. | Max. | Unit |
|---------------|-------------------------------|------------------------------------------------------------------------------------------------------------------|------|------|------|------|
| $I_{SD}$      | Source-drain Current          |                                                                                                                  |      |      | 38   | A    |
| $I_{SDM} (1)$ | Source-drain Current (pulsed) |                                                                                                                  |      |      | 152  | A    |
| $V_{SD} (2)$  | Forward On Voltage            | $I_{SD} = 38A$ , $V_{GS} = 0$                                                                                    |      |      | 1.5  | V    |
| $t_{rr}$      | Reverse Recovery Time         | $I_{SD} = 38A$ , $di/dt = 100A/\mu s$ ,<br>$V_{DD} = 100V$ , $T_j = 150^\circ C$<br>(see test circuit, Figure 5) |      | 95   |      | ns   |
| $Q_{rr}$      | Reverse Recovery Charge       |                                                                                                                  |      | 260  |      | nC   |
| $I_{RRM}$     | Reverse Recovery Current      |                                                                                                                  |      | 5.5  |      | A    |

Note: 1. Pulsed: Pulse duration = 300  $\mu s$ , duty cycle 1.5 %.  
2. Pulse width limited by safe operating area.

Fig. 1: Unclamped Inductive Load Test Circuit

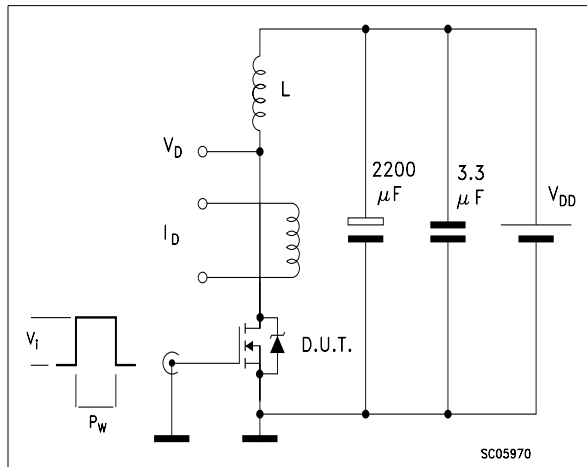


Fig. 2: Unclamped Inductive Waveform

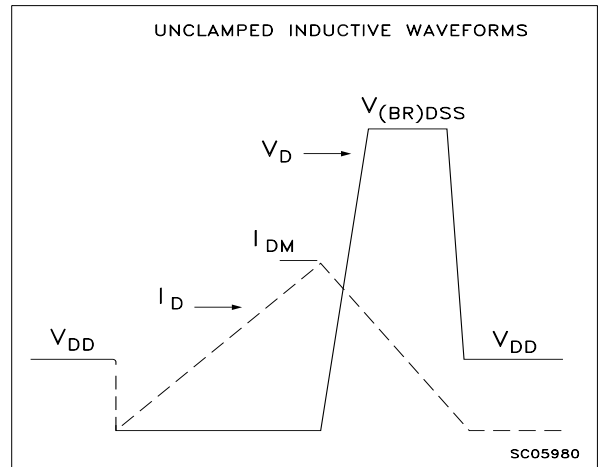


Fig. 3: Switching Times Test Circuit For Resistive Load

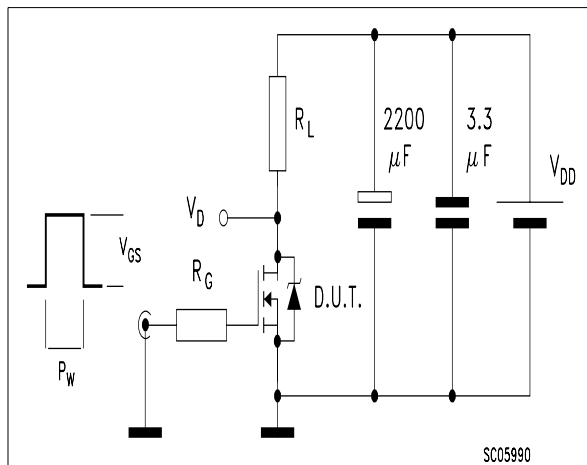


Fig. 4: Gate Charge test Circuit

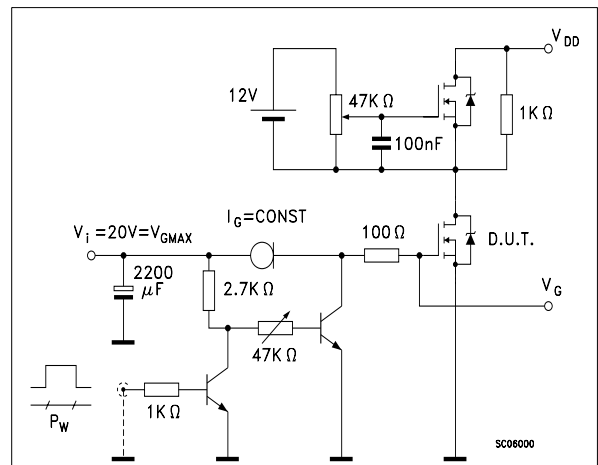
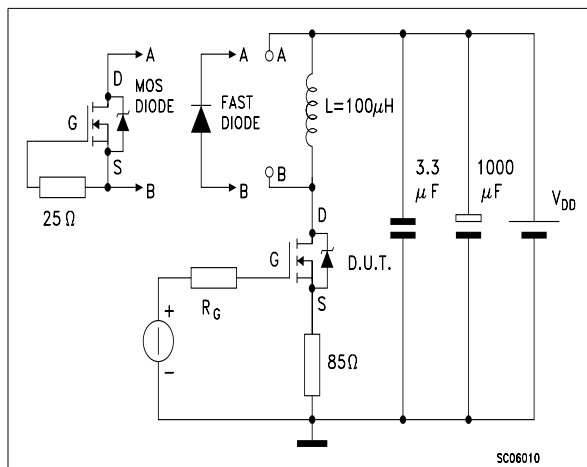
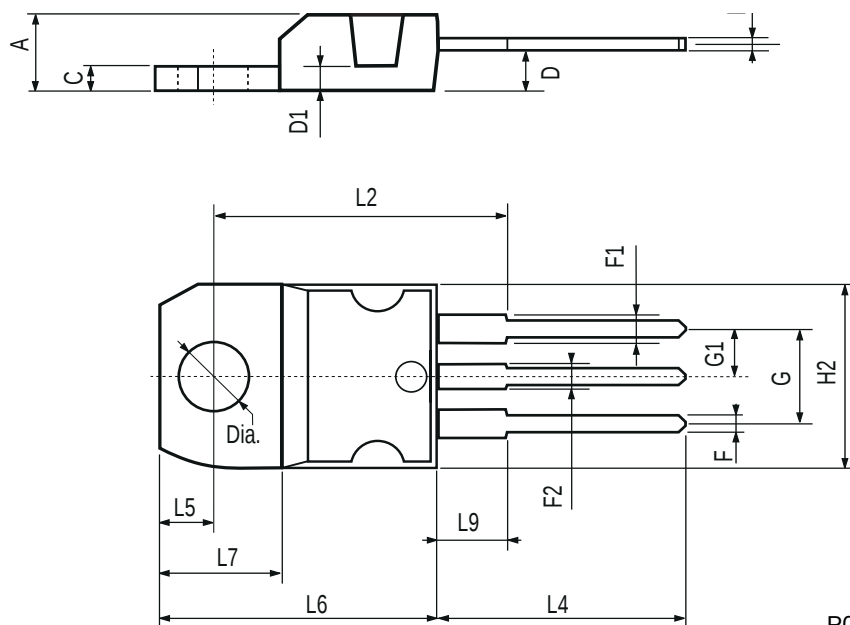


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



## TO-220 MECHANICAL DATA

| DIM. | mm    |      |       | inch  |       |       |
|------|-------|------|-------|-------|-------|-------|
|      | MIN.  | TYP. | MAX.  | MIN.  | TYP.  | MAX.  |
| A    | 4.40  |      | 4.60  | 0.173 |       | 0.181 |
| C    | 1.23  |      | 1.32  | 0.048 |       | 0.051 |
| D    | 2.40  |      | 2.72  | 0.094 |       | 0.107 |
| D1   |       | 1.27 |       |       | 0.050 |       |
| E    | 0.49  |      | 0.70  | 0.019 |       | 0.027 |
| F    | 0.61  |      | 0.88  | 0.024 |       | 0.034 |
| F1   | 1.14  |      | 1.70  | 0.044 |       | 0.067 |
| F2   | 1.14  |      | 1.70  | 0.044 |       | 0.067 |
| G    | 4.95  |      | 5.15  | 0.194 |       | 0.203 |
| G1   | 2.4   |      | 2.7   | 0.094 |       | 0.106 |
| H2   | 10.0  |      | 10.40 | 0.393 |       | 0.409 |
| L2   |       | 16.4 |       |       | 0.645 |       |
| L4   | 13.0  |      | 14.0  | 0.511 |       | 0.551 |
| L5   | 2.65  |      | 2.95  | 0.104 |       | 0.116 |
| L6   | 15.25 |      | 15.75 | 0.600 |       | 0.620 |
| L7   | 6.2   |      | 6.6   | 0.244 |       | 0.260 |
| L9   | 3.5   |      | 3.93  | 0.137 |       | 0.154 |
| DIA. | 3.75  |      | 3.85  | 0.147 |       | 0.151 |



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