



# STP80NF03L-04

## N-CHANNEL 30V - 0.0034 $\Omega$ - 80A TO-220 STripFET™ POWER MOSFET

### PRELIMINARY DATA

| TYPE          | V <sub>DSS</sub> | R <sub>DS(on)</sub> | I <sub>D</sub> |
|---------------|------------------|---------------------|----------------|
| STP80NF03L-04 | 30 V             | < 0.004 $\Omega$    | 80 A           |

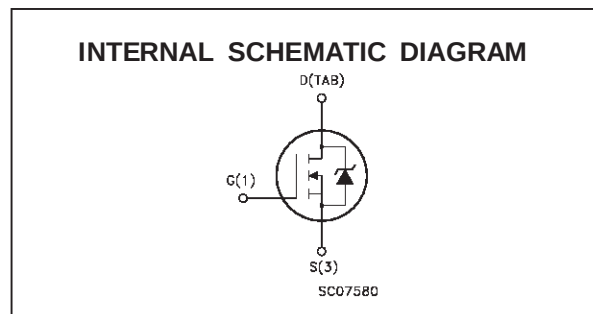
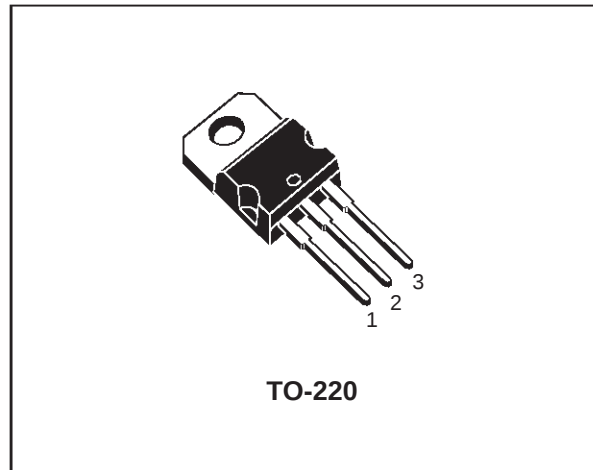
- TYPICAL R<sub>DS(on)</sub> = 0.0034  $\Omega$
- EXCEPTIONAL dv/dt CAPABILITY
- 100% AVALANCHE TESTED
- LOW GATE CHARGE 100 °C
- APPLICATION ORIENTED CHARACTERIZATION

### 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 CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- DC-DC & DC-AC CONVERTERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc. )



### ABSOLUTE MAXIMUM RATINGS

| Symbol              | Parameter                                              | Value      | Unit |
|---------------------|--------------------------------------------------------|------------|------|
| V <sub>DS</sub>     | Drain-source Voltage (V <sub>GS</sub> = 0)             | 30         | V    |
| V <sub>DGR</sub>    | Drain- gate Voltage (R <sub>GS</sub> = 20 k $\Omega$ ) | 30         | V    |
| V <sub>GS</sub>     | Gate-source Voltage                                    | $\pm 20$   | V    |
| I <sub>D</sub> (●●) | Drain Current (continuous) at T <sub>c</sub> = 25 °C   | 80         | A    |
| I <sub>D</sub>      | Drain Current (continuous) at T <sub>c</sub> = 100 °C  | 56         | A    |
| I <sub>DM</sub> (●) | Drain Current (pulsed)                                 | 320        | A    |
| P <sub>tot</sub>    | Total Dissipation at T <sub>c</sub> = 25 °C            | 210        | W    |
|                     | Derating Factor                                        | 1.43       | W/°C |
| E <sub>AS</sub> (1) | Single Pulse Avalanche Energy                          | 2          | J    |
| 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

(●●) Current limited by package

(1) starting T<sub>j</sub> = 25 °C, I<sub>D</sub> = 40A, V<sub>DD</sub> = 15V

## THERMAL DATA

|                |                                                |     |      |               |
|----------------|------------------------------------------------|-----|------|---------------|
| $R_{thj-case}$ | Thermal Resistance Junction-case               | Max | 0.7  | $^{\circ}C/W$ |
| $R_{thj-amb}$  | Thermal Resistance Junction-ambient            | Max | 62.5 | $^{\circ}C/W$ |
| $R_{thc-sink}$ | Thermal Resistance Case-sink                   | Typ | 0.5  | $^{\circ}C/W$ |
| $T_I$          | Maximum Lead Temperature For Soldering Purpose |     | 300  | $^{\circ}C$   |

ELECTRICAL CHARACTERISTICS ( $T_{case} = 25^{\circ}C$  unless otherwise specified)

## OFF

| Symbol        | Parameter                                        | Test Conditions                                                                   | Min. | Typ. | Max.      | Unit               |
|---------------|--------------------------------------------------|-----------------------------------------------------------------------------------|------|------|-----------|--------------------|
| $V_{(BR)DSS}$ | Drain-source Breakdown Voltage                   | $I_D = 250 \mu A$ $V_{GS} = 0$                                                    | 30   |      |           | V                  |
| $I_{DSS}$     | Zero Gate Voltage Drain Current ( $V_{GS} = 0$ ) | $V_{DS} = \text{Max Rating}$<br>$V_{DS} = \text{Max Rating}$ $T_c = 125^{\circ}C$ |      |      | 1<br>10   | $\mu A$<br>$\mu A$ |
| $I_{GSS}$     | Gate-body Leakage Current ( $V_{DS} = 0$ )       | $V_{GS} = \pm 20 V$                                                               |      |      | $\pm 100$ | nA                 |

## ON (\*)

| Symbol       | Parameter                         | Test Conditions                                              | Min. | Typ.             | Max.            | Unit                 |
|--------------|-----------------------------------|--------------------------------------------------------------|------|------------------|-----------------|----------------------|
| $V_{GS(th)}$ | Gate Threshold Voltage            | $V_{DS} = V_{GS}$ $I_D = 250 \mu A$                          | 1    | 1.7              | 2.5             | V                    |
| $R_{DS(on)}$ | Static Drain-source On Resistance | $V_{GS} = 10V$ $I_D = 40 A$<br>$V_{GS} = 4.5V$ $I_D = 40 A$  |      | 0.0034<br>0.0042 | 0.004<br>0.0055 | $\Omega$<br>$\Omega$ |
| $I_{D(on)}$  | On State Drain Current            | $V_{DS} > I_{D(on)} \times R_{DS(on)max}$<br>$V_{GS} = 10 V$ | 80   |                  |                 | A                    |

## DYNAMIC

| Symbol                              | Parameter                                                               | Test Conditions                                        | Min. | Typ.                | Max. | Unit           |
|-------------------------------------|-------------------------------------------------------------------------|--------------------------------------------------------|------|---------------------|------|----------------|
| $g_{fs} (*)$                        | Forward Transconductance                                                | $V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 15 A$ |      | 50                  |      | S              |
| $C_{iss}$<br>$C_{oss}$<br>$C_{rss}$ | Input Capacitance<br>Output Capacitance<br>Reverse Transfer Capacitance | $V_{DS} = 25 V$ $f = 1 MHz$ $V_{GS} = 0$               |      | 7000<br>1700<br>600 |      | pF<br>pF<br>pF |

**ELECTRICAL CHARACTERISTICS** (continued)**SWITCHING ON**

| Symbol      | Parameter          | Test Conditions                                                             | Min. | Typ. | Max. | Unit |
|-------------|--------------------|-----------------------------------------------------------------------------|------|------|------|------|
| $t_{d(on)}$ | Turn-on Delay Time | $V_{DD} = 15\text{ V}$ $I_D = 40\text{ A}$                                  |      | 50   |      | ns   |
| $t_r$       | Rise Time          | $R_G = 4.7\ \Omega$ $V_{GS} = 4.5\text{ V}$<br>(Resistive Load, see fig. 3) |      | 275  |      | ns   |
| $Q_g$       | Total Gate Charge  | $V_{DD} = 24\text{ V}$ $I_D = 80\text{ A}$ $V_{GS} = 4.5\text{ V}$          |      | 120  | 160  | nC   |
| $Q_{gs}$    | Gate-Source Charge |                                                                             |      | 37   |      | nC   |
| $Q_{gd}$    | Gate-Drain Charge  |                                                                             |      | 58   |      | nC   |

**SWITCHING OFF**

| Symbol         | Parameter             | Test Conditions                                                             | Min. | Typ. | Max. | Unit |
|----------------|-----------------------|-----------------------------------------------------------------------------|------|------|------|------|
| $t_{d(off)}$   | Turn-off Delay Time   | $V_{DD} = 15\text{ V}$ $I_D = 40\text{ A}$                                  |      | 230  |      | ns   |
| $t_f$          | Fall Time             | $R_G = 4.7\ \Omega$ $V_{GS} = 4.5\text{ V}$<br>(Resistive Load, see fig. 3) |      | 190  |      | ns   |
| $t_r(V_{off})$ | Off-voltage Rise Time | $V_{clamp} = 24\text{ V}$ $I_D = 80\text{ A}$                               |      | 175  |      | ns   |
| $t_f$          | Fall Time             | $R_G = 4.7\ \Omega$ $V_{GS} = 4.5\text{ V}$                                 |      | 280  |      | ns   |
| $t_c$          | Cross-over Time       | (Inductive Load, see fig. 5)                                                |      | 470  |      | ns   |

**SOURCE DRAIN DIODE**

| Symbol             | Parameter                     | Test Conditions                                                                                                                                     | Min. | Typ.  | Max. | Unit          |
|--------------------|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|------|---------------|
| $I_{SD}$           | Source-drain Current          |                                                                                                                                                     |      |       | 80   | A             |
| $I_{SDM}(\bullet)$ | Source-drain Current (pulsed) |                                                                                                                                                     |      |       | 320  | A             |
| $V_{SD} (*)$       | Forward On Voltage            | $I_{SD} = 80\text{ A}$ $V_{GS} = 0$                                                                                                                 |      |       | 1.5  | V             |
| $t_{rr}$           | Reverse Recovery Time         | $I_{SD} = 80\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$<br>$V_{DD} = 20\text{ V}$ $T_J = 150\text{ }^\circ\text{C}$<br>(see test circuit, fig. 5) |      | 88    |      | ns            |
| $Q_{rr}$           | Reverse Recovery Charge       |                                                                                                                                                     |      | 0.176 |      | $\mu\text{C}$ |
| $I_{RRM}$          | Reverse Recovery Current      |                                                                                                                                                     |      | 4.4   |      | A             |

(\*) Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

Fig. 1: Unclamped Inductive Load Test Circuit



Fig. 2: Unclamped Inductive Waveform



Fig. 3: Switching Times Test Circuits For Resistive Load



Fig. 4: Gate Charge test Circuit

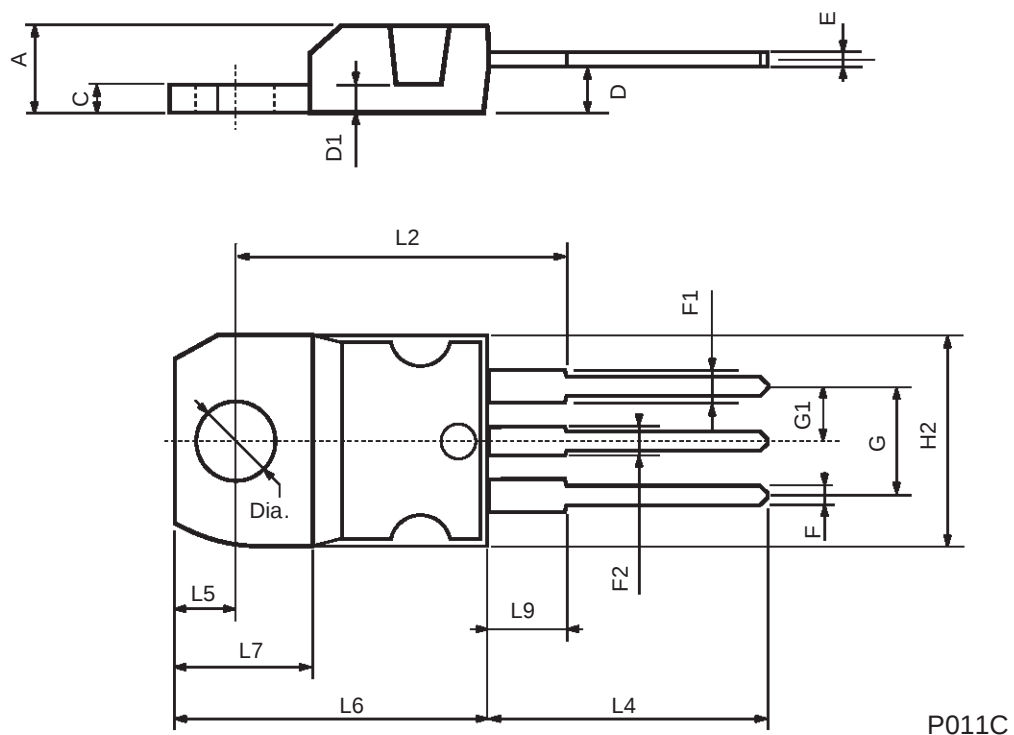


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



## 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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