



# STP5NB90 STP5NB90FP

N - CHANNEL 900V - 2.3  $\Omega$  - 5A - TO-220/TO-220FP  
PowerMESH™ MOSFET

## PRELIMINARY DATA

| TYPE       | V <sub>DSS</sub> | R <sub>DS(on)</sub> | I <sub>D</sub> |
|------------|------------------|---------------------|----------------|
| STP5NB90   | 900 V            | < 2.5 $\Omega$      | 5 A            |
| STP5NB90FP | 900 V            | < 2.5 $\Omega$      | 5 A            |

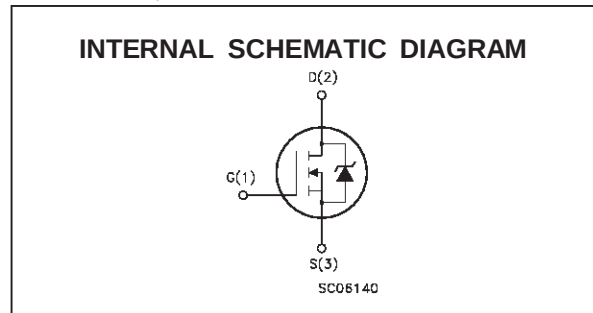
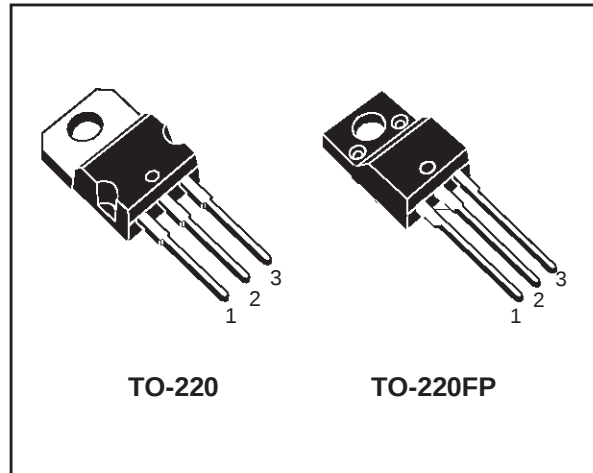
- TYPICAL R<sub>DS(on)</sub> = 2.3  $\Omega$
- EXTREMELY HIGH dv/dt CAPABILITY
- 100% AVALANCHE TESTED
- VERY LOW INTRINSIC CAPACITANCES
- GATE CHARGE MINIMIZED

## DESCRIPTION

Using the latest high voltage MESH OVERLAY™ process, STMicroelectronics has designed an advanced family of power MOSFETs with outstanding performances. The new patent pending strip layout coupled with the Company's proprietary edge termination structure, gives the lowest RDS(on) per area, exceptional avalanche and dv/dt capabilities and unrivalled gate charge and switching characteristics.

## APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- UNINTERRUPTIBLE POWER SUPPLY(UPS)
- DC-DC & DC-AC CONVERTERS FOR TELECOM, INDUSTRIAL AND CONSUMER ENVIRONMENT



## ABSOLUTE MAXIMUM RATINGS

| Symbol              | Parameter                                              | Value      |            | Unit |
|---------------------|--------------------------------------------------------|------------|------------|------|
|                     |                                                        | STP5NB90   | STP5NB90FP |      |
| V <sub>DS</sub>     | Drain-source Voltage (V <sub>GS</sub> = 0)             | 900        |            | V    |
| V <sub>DGR</sub>    | Drain- gate Voltage (R <sub>GS</sub> = 20 k $\Omega$ ) | 900        |            | V    |
| V <sub>GS</sub>     | Gate-source Voltage                                    | $\pm 30$   |            | V    |
| I <sub>D</sub>      | Drain Current (continuous) at T <sub>c</sub> = 25 °C   | 5          | 5(*)       | A    |
| I <sub>D</sub>      | Drain Current (continuous) at T <sub>c</sub> = 100 °C  | 3.1        | 3.1(*)     | A    |
| I <sub>DM</sub> (•) | Drain Current (pulsed)                                 | 20         | 20         | A    |
| P <sub>tot</sub>    | Total Dissipation at T <sub>c</sub> = 25 °C            | 125        | 40         | W    |
|                     | Derating Factor                                        | 1.0        | 0.32       | W/°C |
| dv/dt(1)            | Peak Diode Recovery voltage slope                      | 4.5        | 4.5        | V/ns |
| V <sub>ISO</sub>    | Insulation Withstand Voltage (DC)                      | —          | 2000       | V    |
| T <sub>stg</sub>    | Storage Temperature                                    | -65 to 150 |            | °C   |
| T <sub>j</sub>      | Max. Operating Junction Temperature                    | 150        |            | °C   |

(•) Pulse width limited by safe operating area

(\*) Limited only by maximum temperature allowed

(1) I<sub>SD</sub>  $\leq 5$  A, di/dt  $\leq 200$  A/ $\mu$ s, V<sub>DD</sub>  $\leq$  V<sub>(BR)DSS</sub>, T<sub>j</sub>  $\leq$  T<sub>JMAX</sub>

## THERMAL DATA

|                       |                                                |     | TO-220 | TO220-FP |      |
|-----------------------|------------------------------------------------|-----|--------|----------|------|
| R <sub>thj-case</sub> | Thermal Resistance Junction-case               | Max | 1      | 3.13     | °C/W |
| R <sub>thj-amb</sub>  | Thermal Resistance Junction-ambient            | Max | 62.5   |          | °C/W |
| R <sub>thc-sink</sub> | Thermal Resistance Case-sink                   | Typ | 0.5    |          | °C/W |
| T <sub>l</sub>        | Maximum Lead Temperature For Soldering Purpose |     | 300    |          | °C   |

## AVALANCHE CHARACTERISTICS

| Symbol   | Parameter                                                                                           | Max Value | Unit |
|----------|-----------------------------------------------------------------------------------------------------|-----------|------|
| $I_{AR}$ | Avalanche Current, Repetitive or Not-Repetitive                                                     | 5         | A    |
| $E_{AS}$ | Single Pulse Avalanche Energy<br>(starting $T_j = 25^{\circ}C$ , $I_D = I_{AR}$ , $V_{DD} = 50 V$ ) | 318       | mJ   |

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                   | $I_D = 250 \mu A$ $V_{GS} = 0$                                                    | 900  |      |           | 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>50   | $\mu A$<br>$\mu A$ |
| $I_{GSS}$     | Gate-body Leakage Current ( $V_{DS} = 0$ )       | $V_{GS} = \pm 30 V$                                                               |      |      | $\pm 100$ | nA                 |

## ON (\*)

| Symbol       | Parameter                         | Test Conditions                                              | Min. | Typ. | Max. | Unit     |
|--------------|-----------------------------------|--------------------------------------------------------------|------|------|------|----------|
| $V_{GS(th)}$ | Gate Threshold Voltage            | $V_{DS} = V_{GS}$ $I_D = 250 \mu A$                          | 3    | 4    | 5    | V        |
| $R_{DS(on)}$ | Static Drain-source On Resistance | $V_{GS} = 10V$ $I_D = 2.5 A$                                 |      | 2.3  | 2.5  | $\Omega$ |
| $I_{D(on)}$  | On State Drain Current            | $V_{DS} > I_{D(on)} \times R_{DS(on)max}$<br>$V_{GS} = 10 V$ | 5    |      |      | A        |

## DYNAMIC

| Symbol       | Parameter                    | Test Conditions                                         | Min. | Typ. | Max. | Unit |
|--------------|------------------------------|---------------------------------------------------------|------|------|------|------|
| $g_{fs} (*)$ | Forward Transconductance     | $V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 2.5 A$ | 2.5  | 4.1  |      | S    |
| $C_{iss}$    | Input Capacitance            | $V_{DS} = 25 V$ $f = 1 MHz$ $V_{GS} = 0$                |      | 1250 | 1625 | pF   |
| $C_{oss}$    | Output Capacitance           |                                                         |      | 128  | 170  | pF   |
| $C_{rss}$    | Reverse Transfer Capacitance |                                                         |      | 13   | 20   | pF   |

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

| Symbol      | Parameter          | Test Conditions                                                   | Min. | Typ. | Max. | Unit |
|-------------|--------------------|-------------------------------------------------------------------|------|------|------|------|
| $t_{d(on)}$ | Turn-on Time       | $V_{DD} = 450\text{ V}$ $I_D = 2.5\text{ A}$                      |      | 18   | 26   | ns   |
| $t_r$       | Rise Time          | $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$                        |      | 9    | 13   | ns   |
| $Q_g$       | Total Gate Charge  | $V_{DD} = 720\text{ V}$ $I_D = 5\text{ A}$ $V_{GS} = 10\text{ V}$ |      | 33   | 47   | nC   |
| $Q_{gs}$    | Gate-Source Charge |                                                                   |      | 10   |      | nC   |
| $Q_{gd}$    | Gate-Drain Charge  |                                                                   |      | 13   |      | nC   |

**SWITCHING OFF**

| Symbol        | Parameter             | Test Conditions                            | Min. | Typ. | Max. | Unit |
|---------------|-----------------------|--------------------------------------------|------|------|------|------|
| $t_{r(Voff)}$ | Off-voltage Rise Time | $V_{DD} = 720\text{ V}$ $I_D = 5\text{ A}$ |      | 13   | 18   | ns   |
| $t_f$         | Fall Time             | $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ |      | 10   | 14   | ns   |
| $t_c$         | Cross-over Time       |                                            |      | 17   | 24   | ns   |

**SOURCE DRAIN DIODE**

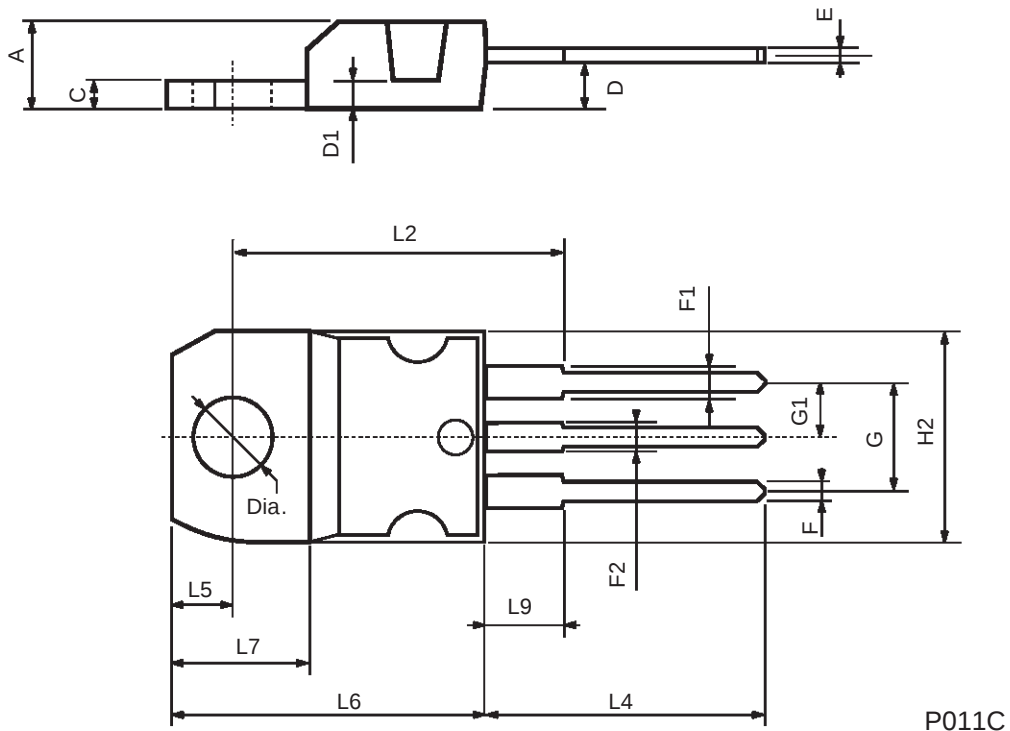
| Symbol             | Parameter                     | Test Conditions                                                                                                       | Min. | Typ. | Max. | Unit          |
|--------------------|-------------------------------|-----------------------------------------------------------------------------------------------------------------------|------|------|------|---------------|
| $I_{SD}$           | Source-drain Current          |                                                                                                                       |      |      | 5    | A             |
| $I_{SDM}(\bullet)$ | Source-drain Current (pulsed) |                                                                                                                       |      |      | 20   | A             |
| $V_{SD} (*)$       | Forward On Voltage            | $I_{SD} = 5\text{ A}$ $V_{GS} = 0$                                                                                    |      |      | 1.6  | V             |
| $t_{rr}$           | Reverse Recovery Time         | $I_{SD} = 5\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$<br>$V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ |      | 700  |      | ns            |
| $Q_{rr}$           | Reverse Recovery Charge       |                                                                                                                       |      | 5.4  |      | $\mu\text{C}$ |
| $I_{RRM}$          | Reverse Recovery Current      |                                                                                                                       |      | 16   |      | A             |

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

(\bullet) Pulse width limited by safe operating area

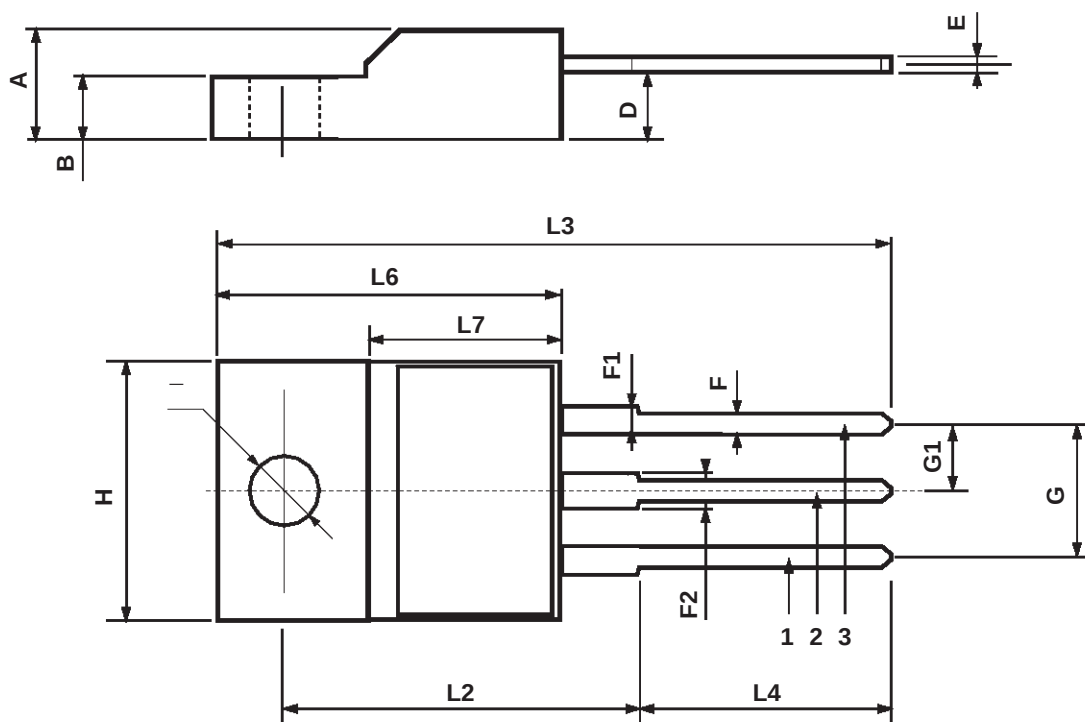
TO-220 MECHANICAL DATA

| 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 |



## TO-220FP MECHANICAL DATA

| DIM. | mm   |      |      | inch  |       |       |
|------|------|------|------|-------|-------|-------|
|      | MIN. | TYP. | MAX. | MIN.  | TYP.  | MAX.  |
| A    | 4.4  |      | 4.6  | 0.173 |       | 0.181 |
| B    | 2.5  |      | 2.7  | 0.098 |       | 0.106 |
| D    | 2.5  |      | 2.75 | 0.098 |       | 0.108 |
| E    | 0.45 |      | 0.7  | 0.017 |       | 0.027 |
| F    | 0.75 |      | 1    | 0.030 |       | 0.039 |
| F1   | 1.15 |      | 1.7  | 0.045 |       | 0.067 |
| F2   | 1.15 |      | 1.7  | 0.045 |       | 0.067 |
| G    | 4.95 |      | 5.2  | 0.195 |       | 0.204 |
| G1   | 2.4  |      | 2.7  | 0.094 |       | 0.106 |
| H    | 10   |      | 10.4 | 0.393 |       | 0.409 |
| L2   |      | 16   |      |       | 0.630 |       |
| L3   | 28.6 |      | 30.6 | 1.126 |       | 1.204 |
| L4   | 9.8  |      | 10.6 | 0.385 |       | 0.417 |
| L6   | 15.9 |      | 16.4 | 0.626 |       | 0.645 |
| L7   | 9    |      | 9.3  | 0.354 |       | 0.366 |
| Ø    | 3    |      | 3.2  | 0.118 |       | 0.126 |



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