

## STP20NF20-VB Datasheet

### N-Channel 200 V (D-S) MOSFET

| PRODUCT SUMMARY |                           |           |
|-----------------|---------------------------|-----------|
| $V_{DS}$ (V)    | $R_{DS(on)}$ ( $\Omega$ ) | $I_D$ (A) |
| 200             | 0.110 at $V_{GS} = 10$ V  | 30        |

#### FEATURES

- TrenchFET<sup>®</sup> Power MOSFET
- 175 °C Junction Temperature
- PWM Optimized
- 100 %  $R_g$  Tested
- Compliant to RoHS Directive 2002/95/EC



**RoHS**  
COMPLIANT

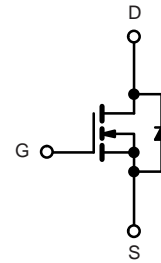
#### APPLICATIONS

- Primary Side Switch

TO-220AB



DRAIN connected to TAB



N-Channel MOSFET

| ABSOLUTE MAXIMUM RATINGS ( $T_A = 25$ °C, unless otherwise noted) |                |                |                  |      |
|---|----------------|----------------|------------------|------|
| Parameter   |                | Symbol         | Limit            | Unit |
| Drain-Source Voltage  |                | $V_{DS}$       | 200              | V    |
| Gate-Source Voltage   |                | $V_{GS}$       | $\pm 20$         |      |
| Continuous Drain Current ( $T_J = 175$ °C) <sup>b</sup>           | $T_C = 25$ °C  | $I_D$          | 30               | A    |
|   | $T_C = 125$ °C |                | 15               |      |
| Pulsed Drain Current  |                | $I_{DM}$       | 70               |      |
| Continuous Source Current (Diode Conduction)                      |                | $I_S$          | 12               |      |
| Avalanche Current   |                | $I_{AS}$       | 12               |      |
| Single Pulse Avalanche Energy                                     | $L = 0.1$ mH   | $E_{AS}$       | 20               | mJ   |
| Maximum Power Dissipation   | $T_C = 25$ °C  | $P_D$          | 126 <sup>b</sup> | W    |
|   | $T_A = 25$ °C  |                | 3 <sup>a</sup>   |      |
| Operating Junction and Storage Temperature Range                  |                | $T_J, T_{stg}$ | - 55 to 175      | °C   |

| THERMAL RESISTANCE RATINGS       |               |            |         |         |      |
|----------------------------------|---------------|------------|---------|---------|------|
| Parameter                        |               | Symbol     | Typical | Maximum | Unit |
| Junction-to-Ambient <sup>a</sup> | $t \leq 10$ s | $R_{thJA}$ | 15      | 18      | °C/W |
|                                  | Steady State  |            | 40      | 50      |      |
| Junction-to-Case (Drain)         |               | $R_{thJC}$ | 0.85    | 1.1     |      |

Notes:

a. Surface mounted on 1" x 1" FR4 board.

b. See SOA curve for voltage derating.

| <b>SPECIFICATIONS</b> ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted)         |              |  |      |                   |           |               |
|--|--------------|--|------|-------------------|-----------|---------------|
| Parameter  | Symbol       | Test Conditions  | Min. | Typ. <sup>a</sup> | Max.      | Unit          |
| <b>Static</b>  |              |  |      |                   |           |               |
| Drain-Source Breakdown Voltage   | $V_{DS}$     | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$  | 200  |                   |           | V             |
| Gate Threshold Voltage   | $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$  | 1    |                   | 3         |               |
| Gate-Body Leakage  | $I_{GSS}$    | $V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$  |      |                   | $\pm 100$ | nA            |
| Zero Gate Voltage Drain Current  | $I_{DSS}$    | $V_{DS} = 200\text{ V}, V_{GS} = 0\text{ V}$   |      |                   | 1         | $\mu\text{A}$ |
|  |              | $V_{DS} = 200\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$  |      |                   | 50        |               |
|  |              | $V_{DS} = 200\text{ V}, V_{GS} = 0\text{ V}, T_J = 175\text{ }^\circ\text{C}$  |      |                   | 250       |               |
| On-State Drain Current <sup>b</sup>  | $I_{D(on)}$  | $V_{DS} = 5\text{ V}, V_{GS} = 10\text{ V}$  | 40   |                   |           | A             |
| Drain-Source On-State Resistance <sup>b</sup>  | $R_{DS(on)}$ | $V_{GS} = 10\text{ V}, I_D = 3\text{ A}$   |      | 0.110             | 0.125     | $\Omega$      |
|  |              | $V_{GS} = 10\text{ V}, I_D = 3\text{ A}, T_J = 125\text{ }^\circ\text{C}$  |      | 0.120             | 0.140     |               |
|  |              | $V_{GS} = 10\text{ V}, I_D = 3\text{ A}, T_J = 175\text{ }^\circ\text{C}$  |      | 0.130             | 0.150     |               |
|  |              | $V_{GS} = 4.5\text{ V}, I_D = 3\text{ A}$  |      | 0.132             | 0.152     |               |
| Forward Transconductance <sup>b</sup>  | $g_{fs}$     | $V_{DS} = 15\text{ V}, I_D = 3\text{ A}$   |      | 35                |           | S             |
| <b>Dynamic<sup>a</sup></b>   |              |  |      |                   |           |               |
| Input Capacitance  | $C_{iss}$    | $V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, F = 1\text{ MHz}$  |      | 1800              |           | $\mu\text{F}$ |
| Output Capacitance   | $C_{oss}$    |  |      | 180               |           |               |
| Reverse Transfer Capacitance   | $C_{rss}$    |  |      | 80                |           |               |
| Total Gate Charge <sup>c</sup>   | $Q_g$        | $V_{DS} = 100\text{ V}, V_{GS} = 10\text{ V}, I_D = 3\text{ A}$  |      | 34                | 51        | nC            |
| Gate-Source Charge <sup>c</sup>  | $Q_{gs}$     |  |      | 8                 |           |               |
| Gate-Drain Charge <sup>c</sup>   | $Q_{gd}$     |  |      | 12                |           |               |
| Gate Resistance  | $R_g$        |  | 0.5  |                   | 2.9       | $\Omega$      |
| Turn-On Delay Time <sup>c</sup>  | $t_{d(on)}$  | $V_{DD} = 100\text{ V}, R_L = 5.2\text{ }\Omega$<br>$I_D \cong 3\text{ A}, V_{GEN} = 10\text{ V}, R_g = 2.5\text{ }\Omega$ |      | 15                | 25        | ns            |
| Rise Time <sup>c</sup>   | $t_r$        |  |      | 50                | 75        |               |
| Turn-Off Delay Time <sup>c</sup>   | $t_{d(off)}$ |  |      | 30                | 45        |               |
| Fall Time <sup>c</sup>   | $t_f$        |  |      | 60                | 90        |               |
| <b>Source-Drain Diode Ratings and Characteristics</b> ( $T_C = 25\text{ }^\circ\text{C}$ ) |              |  |      |                   |           |               |
| Pulsed Current   | $I_{SM}$     |  |      |                   | 30        | A             |
| Diode Forward Voltage <sup>b</sup>   | $V_{SD}$     | $I_F = 3\text{ A}, V_{GS} = 0\text{ V}$  |      | 0.9               | 1.5       | V             |
| Source-Drain Reverse Recovery Time   | $t_{rr}$     | $I_F = 3\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$   |      | 180               | 250       | ns            |

## Notes:

- a. Guaranteed by design, not subject to production testing.  
 b. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .  
 c. Independent of operating temperature.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



**Output Characteristics**



**Transfer Characteristics**



**Transconductance**



**On-Resistance vs. Drain Current**



**Capacitance**



**Gate Charge**

**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



On-Resistance vs. Junction Temperature



Source-Drain Diode Forward Voltage

**THERMAL RATINGS**

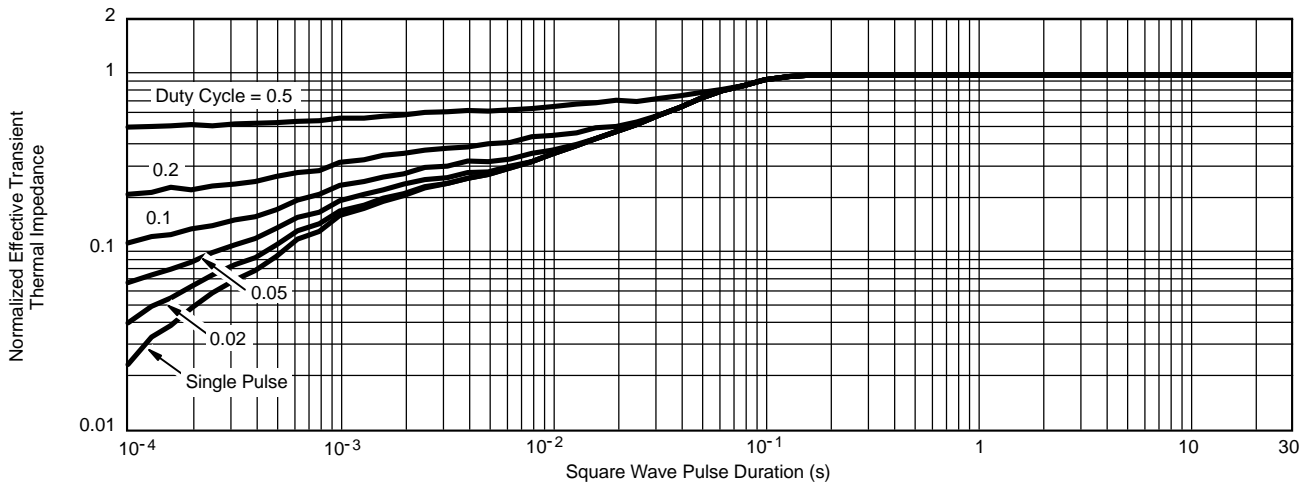


Maximum Avalanche Drain Current vs. Case Temperature



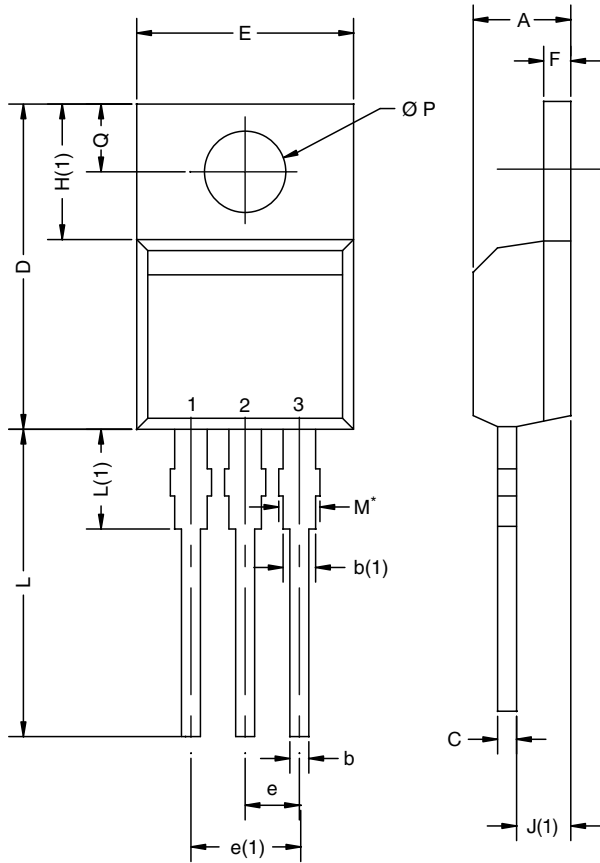
\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified

Safe Operating Area



Normalized Thermal Transient Impedance, Junction-to-Case

TO-220AB

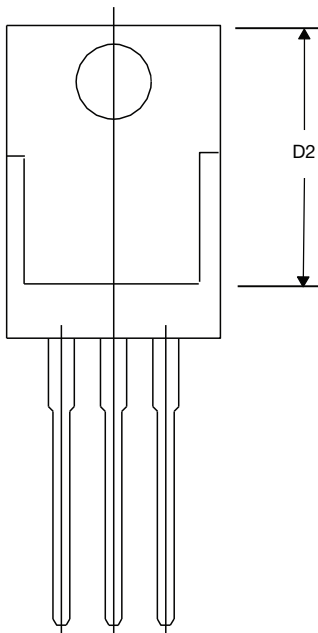


| DIM. | MILLIMETERS |       | INCHES |       |
|------|-------------|-------|--------|-------|
|      | MIN.        | MAX.  | MIN.   | MAX.  |
| A    | 4.25        | 4.65  | 0.167  | 0.183 |
| b    | 0.69        | 1.01  | 0.027  | 0.040 |
| b(1) | 1.20        | 1.73  | 0.047  | 0.068 |
| c    | 0.36        | 0.61  | 0.014  | 0.024 |
| D    | 14.85       | 15.49 | 0.585  | 0.610 |
| D2   | 12.19       | 12.70 | 0.480  | 0.500 |
| E    | 10.04       | 10.51 | 0.395  | 0.414 |
| e    | 2.41        | 2.67  | 0.095  | 0.105 |
| e(1) | 4.88        | 5.28  | 0.192  | 0.208 |
| F    | 1.14        | 1.40  | 0.045  | 0.055 |
| H(1) | 6.09        | 6.48  | 0.240  | 0.255 |
| J(1) | 2.41        | 2.92  | 0.095  | 0.115 |
| L    | 13.35       | 14.02 | 0.526  | 0.552 |
| L(1) | 3.32        | 3.82  | 0.131  | 0.150 |
| Ø P  | 3.54        | 3.94  | 0.139  | 0.155 |
| Q    | 2.60        | 3.00  | 0.102  | 0.118 |

ECN: T14-0413-Rev. P, 16-Jun-14  
DWG: 5471

**Note**

\* M = 1.32 mm to 1.62 mm (dimension including protrusion)  
Heatsink hole for HVM



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