

## SUP28N15-52-VB Datasheet

### N-Channel 150-V (D-S) 175 °C MOSFET

#### PRODUCT SUMMARY

| $V_{DS}$ (V) | $R_{DS(on)}$ ( $\Omega$ ) | $I_D$ (A) |
|--------------|---------------------------|-----------|
| 150          | 0.030 at $V_{GS} = 10$ V  | 50        |
|              | 0.033 at $V_{GS} = 6$ V   | 45        |

#### FEATURES

- Trench Power MOSFETs
- 175 °C Junction Temperature
- New Low Thermal Resistance Package
- PWM Optimized
- Compliant to RoHS Directive 2002/95/EC


**RoHS**  
 COMPLIANT

#### APPLICATIONS

- Primary Side Switch

TO-220AB



Top View



N-Channel MOSFET

#### ABSOLUTE MAXIMUM RATINGS $T_C = 25$ °C, unless otherwise noted

| Parameter                                        | Symbol         | Limit            | Unit |
|--------------------------------------------------|----------------|------------------|------|
| Drain-Source Voltage                             | $V_{DS}$       | 150              | V    |
| Gate-Source Voltage                              | $V_{GS}$       | $\pm 20$         |      |
| Continuous Drain Current ( $T_J = 175$ °C)       | $I_D$          | 50               | A    |
|                                                  |                | 35               |      |
| Pulsed Drain Current                             | $I_{DM}$       | 150              |      |
| Avalanche Current                                | $I_{AR}$       | 50               |      |
| Repetitive Avalanche Energy <sup>a</sup>         | $E_{AR}$       | 80               | mJ   |
| Maximum Power Dissipation <sup>a</sup>           | $P_D$          | 166 <sup>b</sup> | W    |
|                                                  |                | 3.75             |      |
| Operating Junction and Storage Temperature Range | $T_J, T_{stg}$ | - 55 to 175      | °C   |

#### THERMAL RESISTANCE RATINGS

| Parameter                        | Symbol     | Limit | Unit |
|----------------------------------|------------|-------|------|
| Junction-to-Ambient <sup>c</sup> | $R_{thJA}$ | 40    | °C/W |
| Junction-to-Case (Drain)         | $R_{thJC}$ | 0.9   |      |

Notes:

a. Duty cycle  $\leq 1$  %.

b. See SOA curve for voltage derating.

c. When Mounted on 1" square PCB (FR-4 material).

| SPECIFICATIONS $T_J = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted                     |               |                                                                                                                             |      |       |           |               |
|------------------------------------------------------------------------------------------------|---------------|-----------------------------------------------------------------------------------------------------------------------------|------|-------|-----------|---------------|
| Parameter                                                                                      | Symbol        | Test Conditions                                                                                                             | Min. | Typ.  | Max.      | Unit          |
| Static                                                                                         |               |                                                                                                                             |      |       |           |               |
| Drain-Source Breakdown Voltage                                                                 | $V_{DS}$      | $V_{DS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$                                                                         | 150  |       |           | V             |
| Gate-Threshold Voltage                                                                         | $V_{GS(th)}$  | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$                                                                             | 2    |       | 4         |               |
| Gate-Body Leakage                                                                              | $I_{GSS}$     | $V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$                                                                             |      |       | $\pm 100$ | nA            |
| Zero Gate Voltage Drain Current                                                                | $I_{DSS}$     | $V_{DS} = 120\text{ V}, V_{GS} = 0\text{ V}$                                                                                |      |       | 1         | $\mu\text{A}$ |
|                                                                                                |               | $V_{DS} = 120\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^{\circ}\text{C}$                                             |      |       | 50        |               |
|                                                                                                |               | $V_{DS} = 120\text{ V}, V_{GS} = 0\text{ V}, T_J = 175\text{ }^{\circ}\text{C}$                                             |      |       | 250       |               |
| On-State Drain Current <sup>a</sup>                                                            | $I_{D(on)}$   | $V_{DS} \geq 5\text{ V}, V_{GS} = 10\text{ V}$                                                                              | 80   |       |           | A             |
| Drain-Source On-State Resistance <sup>a</sup>                                                  | $R_{DS(on)}$  | $V_{GS} = 10\text{ V}, I_D = 15\text{ A}$                                                                                   |      | 0.030 |           | $\Omega$      |
|                                                                                                |               | $V_{GS} = 6\text{ V}, I_D = 10\text{ A}$                                                                                    |      | 0.033 |           |               |
|                                                                                                |               | $V_{GS} = 10\text{ V}, I_D = 15\text{ A}, T_J = 125\text{ }^{\circ}\text{C}$                                                |      | 0.076 |           |               |
|                                                                                                |               | $V_{GS} = 10\text{ V}, I_D = 15\text{ A}, T_J = 175\text{ }^{\circ}\text{C}$                                                |      | 0.100 |           |               |
| Forward Transconductance <sup>a</sup>                                                          | $g_{fs}$      | $V_{DS} = 15\text{ V}, I_D = 15\text{ A}$                                                                                   | 10   |       |           | S             |
| Dynamic <sup>b</sup>                                                                           |               |                                                                                                                             |      |       |           |               |
| Input Capacitance                                                                              | $C_{iss}$     | $V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1\text{ MHz}$                                                               |      | 2500  |           | pF            |
| Output Capacitance                                                                             | $C_{oss}$     |                                                                                                                             |      | 290   |           |               |
| Reverse Transfer Capacitance                                                                   | $C_{rss}$     |                                                                                                                             |      | 190   |           |               |
| Gate Resistance                                                                                | $R_g$         |                                                                                                                             |      | 2     |           | $\Omega$      |
| Total Gate Charge <sup>c</sup>                                                                 | $Q_g$         | $V_{DS} = 75\text{ V}, V_{GS} = 10\text{ V}, I_D = 40\text{ A}$                                                             |      | 38    | 60        | nC            |
| Gate-Source Charge <sup>c</sup>                                                                | $Q_{gs}$      |                                                                                                                             |      | 13    |           |               |
| Gate-Drain Charge <sup>c</sup>                                                                 | $Q_{gd}$      |                                                                                                                             |      | 13    |           |               |
| Turn-On Delay Time <sup>c</sup>                                                                | $t_{d(on)}$   | $V_{DD} = 75\text{ V}, R_L = 1.80\text{ }\Omega$<br>$I_D \cong 40\text{ A}, V_{GEN} = 10\text{ V}, R_g = 2.5\text{ }\Omega$ |      | 15    | 25        | ns            |
| Rise Time <sup>c</sup>                                                                         | $t_r$         |                                                                                                                             |      | 130   | 200       |               |
| Turn-Off Delay Time <sup>c</sup>                                                               | $t_{d(off)}$  |                                                                                                                             |      | 30    | 45        |               |
| Fall Time <sup>c</sup>                                                                         | $t_f$         |                                                                                                                             |      | 90    | 140       |               |
| Source-Drain Diode Ratings and Characteristics $T_C = 25\text{ }^{\circ}\text{C}$ <sup>b</sup> |               |                                                                                                                             |      |       |           |               |
| Continuous Current                                                                             | $I_S$         |                                                                                                                             |      |       | 40        | A             |
| Pulsed Current                                                                                 | $I_{SM}$      |                                                                                                                             |      |       | 80        |               |
| Forward Voltage <sup>a</sup>                                                                   | $V_{SD}$      | $I_F = 40\text{ A}, V_{GS} = 0\text{ V}$                                                                                    |      | 1.0   | 1.5       | V             |
| Reverse Recovery Time                                                                          | $t_{rr}$      | $I_F = 40\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$                                                                       |      | 100   | 150       | ns            |
| Peak Reverse Recovery Current                                                                  | $I_{RM(REC)}$ |                                                                                                                             |      | 5     | 8         | A             |
| Reverse Recovery Charge                                                                        | $Q_{rr}$      |                                                                                                                             |      | 0.25  | 0.6       | $\mu\text{C}$ |

Notes:

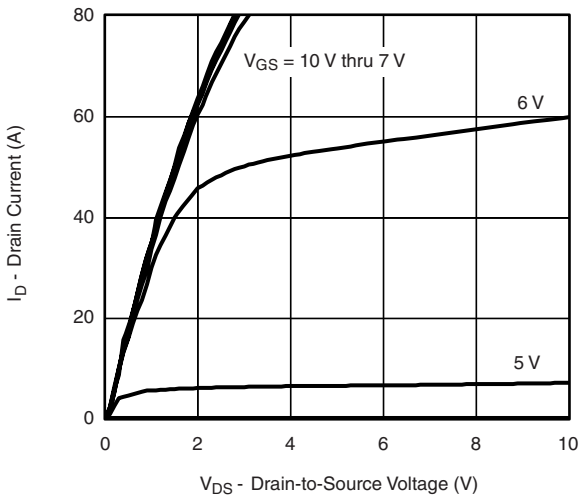
a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ 

b. Guaranteed by design, not subject to production testing.

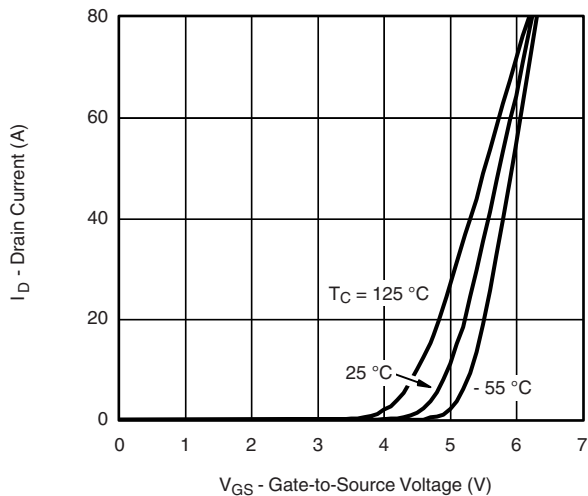
c. Independent of operating temperature.

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.

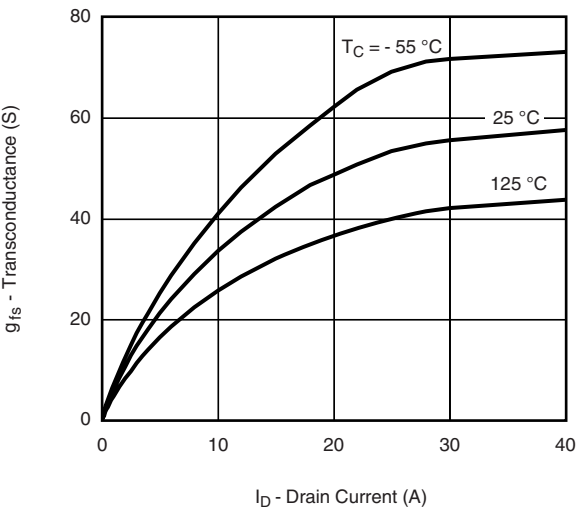
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



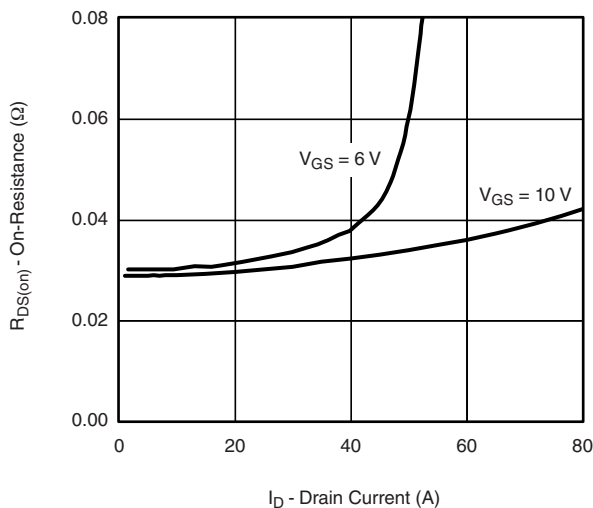
**Output Characteristics**



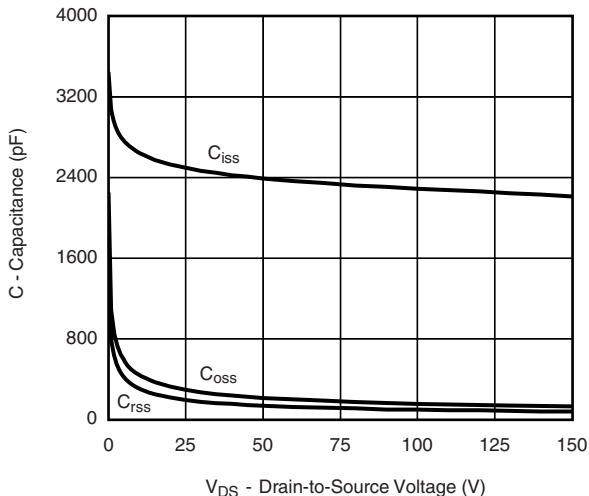
**Transfer Characteristics**



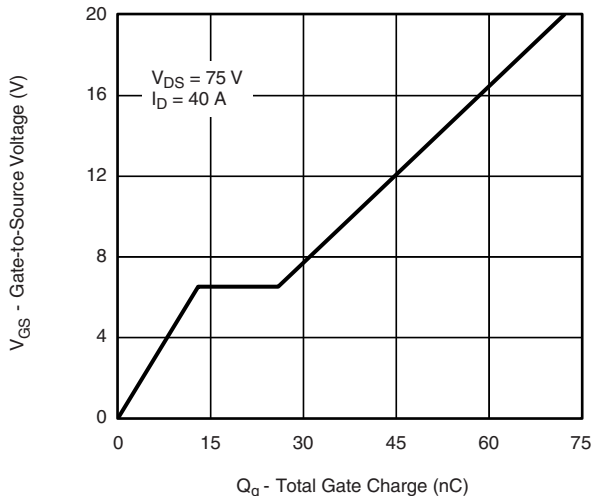
**Transconductance**



**On-Resistance vs. Drain Current**

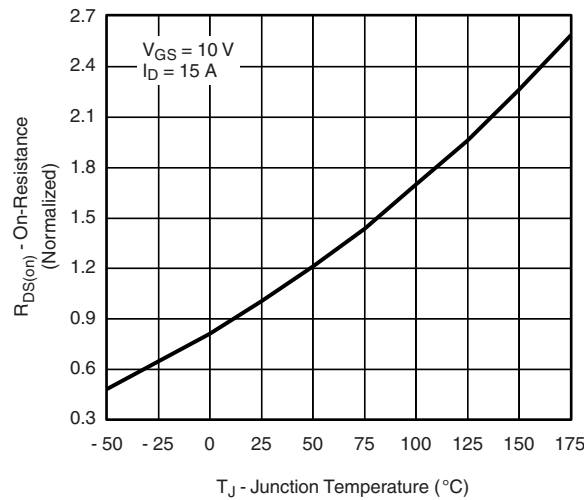


**Capacitance**

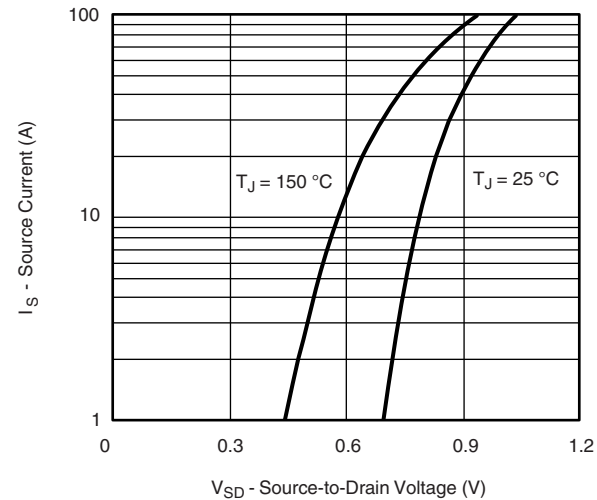


**Gate Charge**

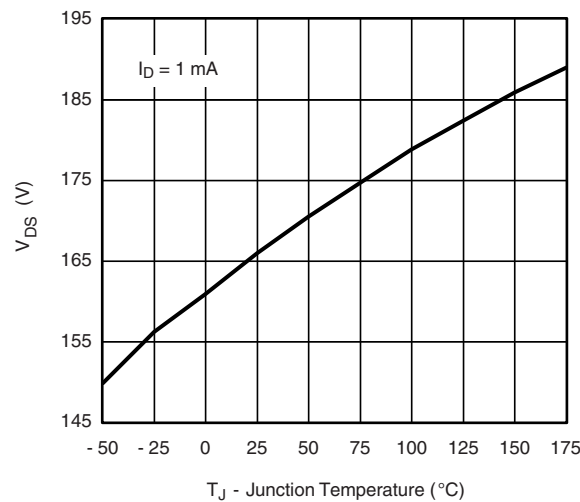
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



**On-Resistance vs. Junction Temperature**



**Source-Drain Diode Forward Voltage**



**Drain Source Breakdown  
vs. Junction Temperature**

THERMAL RATINGS



Maximum Avalanche and Drain Current vs. Case Temperature

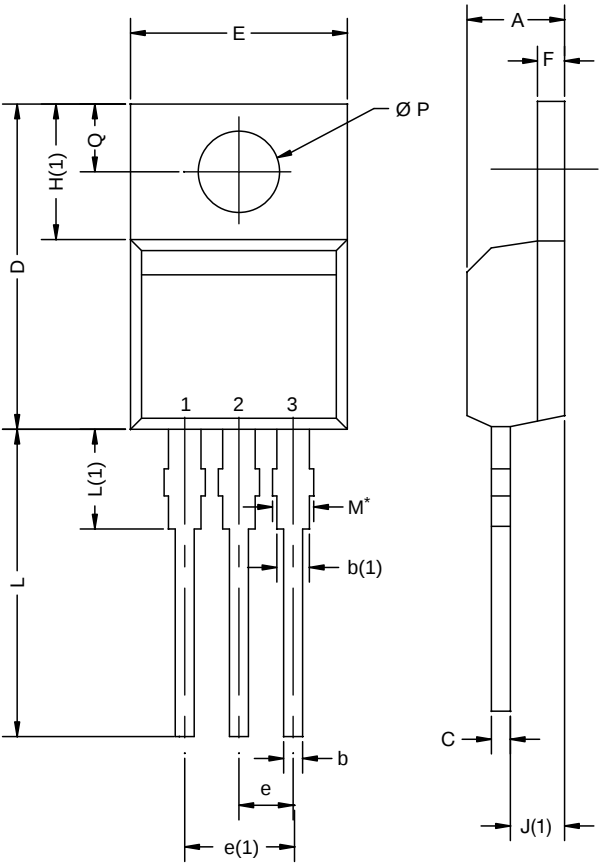


$V_{DS}$  - Drain-to-Source Voltage (V)  
\*  $V_{GS}$  > minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified  
Safe Operating Area



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 |
| 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 |
| $\varnothing P$ | 3.54        | 3.94  | 0.139  | 0.155 |
| Q               | 2.60        | 3.00  | 0.102  | 0.118 |

ECN: X12-0208-Rev. N, 08-Oct-12  
DWG: 5471

Notes

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

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