

## FQPF33N10-VB Datasheet

### N-Channel 100-V (D-S) MOSFET

#### PRODUCT SUMMARY

| $V_{(BR)DSS}$ (V) | $r_{DS(on)}$ ( $\Omega$ ) | $I_D$ (A)       |
|-------------------|---------------------------|-----------------|
| 100               | 0.034 at $V_{GS} = 10$ V  | 50 <sup>a</sup> |

#### FEATURES

- Trench Power MOSFET
- 175 °C Junction Temperature
- Low Thermal Resistance Package
- 100 %  $R_g$  Tested

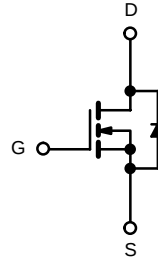
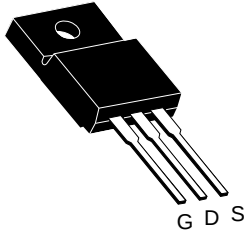


**RoHS**  
COMPLIANT

#### APPLICATIONS

- Isolated DC/DC Converters

TO-220 FULLPAK



N-Channel MOSFET

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

| Parameter                                        | Symbol         | Limit            | Unit |
|--------------------------------------------------|----------------|------------------|------|
| Drain-Source Voltage                             | $V_{DS}$       | 100              | V    |
| Gate-Source Voltage                              | $V_{GS}$       | $\pm 20$         |      |
| Continuous Drain Current ( $T_J = 175$ °C)       | $I_D$          | 50 <sup>a</sup>  | A    |
|                                                  |                | 28 <sup>a</sup>  |      |
| Pulsed Drain Current                             | $I_{DM}$       | 120              |      |
| Avalanche Current                                | $I_{AS}$       | 31               |      |
| Single Pulse Avalanche Energy <sup>b</sup>       | $E_{AS}$       | 61               | mJ   |
| Maximum Power Dissipation <sup>b</sup>           | $P_D$          | 360 <sup>c</sup> | W    |
|                                                  |                | 3.70             |      |
| Operating Junction and Storage Temperature Range | $T_J, T_{stg}$ | - 55 to 175      | °C   |

#### THERMAL RESISTANCE RATINGS

| Parameter                | Symbol     | Limit | Unit |
|--------------------------|------------|-------|------|
| Junction-to-Ambient      | $R_{thJA}$ | 40    | °C/W |
| Junction-to-Case (Drain) | $R_{thJC}$ | 0.4   |      |

Notes:

- Package limited.
- Duty cycle  $\leq 1$  %.
- See SOA curve for voltage derating.
- 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                                                                 | $V_{(BR)DSS}$ | $V_{DS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$                                                                         | 100  |       |           | V             |
| Gate-Threshold Voltage                                                                         | $V_{GS(th)}$  | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$                                                                             | 1.5  |       | 2.5       |               |
| Gate-Body Leakage                                                                              | $I_{GSS}$     | $V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$                                                                             |      |       | $\pm 100$ | nA            |
| Zero Gate Voltage Drain Current                                                                | $I_{DSS}$     | $V_{DS} = 100\text{ V}, V_{GS} = 0\text{ V}$                                                                                |      |       | 1         | $\mu\text{A}$ |
|                                                                                                |               | $V_{DS} = 100\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^{\circ}\text{C}$                                             |      |       | 50        |               |
|                                                                                                |               | $V_{DS} = 100\text{ V}, V_{GS} = 0\text{ V}, T_J = 175\text{ }^{\circ}\text{C}$                                             |      |       | 250       |               |
| On-State Drain Current <sup>a</sup>                                                            | $I_{D(on)}$   | $V_{DS} \geq 5\text{ V}, V_{GS} = 10\text{ V}$                                                                              | 120  |       |           | A             |
| Drain-Source On-State Resistance <sup>a</sup>                                                  | $r_{DS(on)}$  | $V_{GS} = 10\text{ V}, I_D = 30\text{ A}$                                                                                   |      | 0.034 |           | $\Omega$      |
|                                                                                                |               | $V_{GS} = 10\text{ V}, I_D = 30\text{ A}, T_J = 125\text{ }^{\circ}\text{C}$                                                |      | 0.063 |           |               |
|                                                                                                |               | $V_{GS} = 10\text{ V}, I_D = 30\text{ A}, T_J = 175\text{ }^{\circ}\text{C}$                                                |      | 0.084 |           |               |
| Forward Transconductance <sup>a</sup>                                                          | $g_{fs}$      | $V_{DS} = 15\text{ V}, I_D = 30\text{ A}$                                                                                   | 25   |       |           | S             |
| Dynamic <sup>b</sup>                                                                           |               |                                                                                                                             |      |       |           |               |
| Input Capacitance                                                                              | $C_{iss}$     | $V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1\text{ MHz}$                                                               |      | 5100  |           | pF            |
| Output Capacitance                                                                             | $C_{oss}$     |                                                                                                                             |      | 480   |           |               |
| Reverse Transfer Capacitance                                                                   | $C_{rss}$     |                                                                                                                             |      | 210   |           |               |
| Total Gate Charge <sup>c</sup>                                                                 | $Q_g$         | $V_{DS} = 100\text{ V}, V_{GS} = 10\text{ V}, I_D = 65\text{ A}$                                                            |      | 90    | 130       | nC            |
| Gate-Source Charge <sup>c</sup>                                                                | $Q_{gs}$      |                                                                                                                             |      | 23    |           |               |
| Gate-Drain Charge <sup>c</sup>                                                                 | $Q_{gd}$      |                                                                                                                             |      | 34    |           |               |
| Gate Resistance                                                                                | $R_g$         |                                                                                                                             | 0.5  | 1.7   | 3.3       | $\Omega$      |
| Turn-On Delay Time <sup>c</sup>                                                                | $t_{d(on)}$   | $V_{DD} = 100\text{ V}, R_L = 1.5\text{ }\Omega$<br>$I_D \cong 65\text{ A}, V_{GEN} = 10\text{ V}, R_g = 2.5\text{ }\Omega$ |      | 24    | 35        | ns            |
| Rise Time <sup>c</sup>                                                                         | $t_r$         |                                                                                                                             |      | 220   | 330       |               |
| Turn-Off Delay Time <sup>c</sup>                                                               | $t_{d(off)}$  |                                                                                                                             |      | 45    | 70        |               |
| Fall Time <sup>c</sup>                                                                         | $t_f$         |                                                                                                                             |      | 200   | 300       |               |
| Source-Drain Diode Ratings and Characteristics $T_C = 25\text{ }^{\circ}\text{C}$ <sup>b</sup> |               |                                                                                                                             |      |       |           |               |
| Continuous Current                                                                             | $I_S$         |                                                                                                                             |      | 50    |           | A             |
| Pulsed Current                                                                                 | $I_{SM}$      |                                                                                                                             |      | 120   |           |               |
| Forward Voltage <sup>a</sup>                                                                   | $V_{SD}$      | $I_F = 65\text{ A}, V_{GS} = 0\text{ V}$                                                                                    |      | 1.0   | 1.5       | V             |
| Reverse Recovery Time                                                                          | $t_{rr}$      | $I_F = 50\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$                                                                       |      | 130   | 200       | ns            |
| Peak Reverse Recovery Current                                                                  | $I_{RM(REC)}$ |                                                                                                                             |      | 8     | 12        | A             |
| Reverse Recovery Charge                                                                        | $Q_{rr}$      |                                                                                                                             |      | 0.52  | 1.2       | $\mu\text{C}$ |

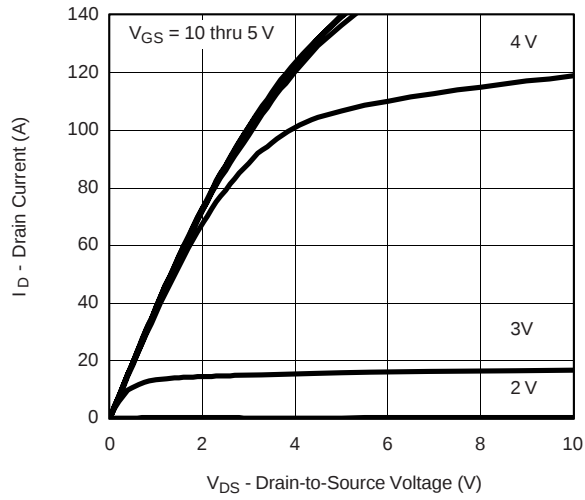
Notes:

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.

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



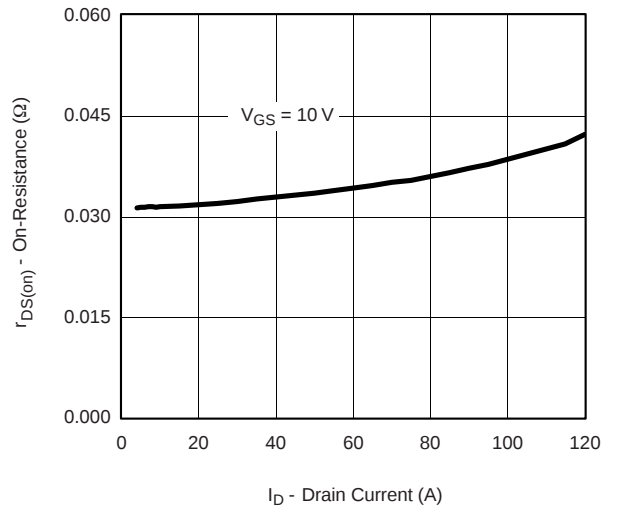
**Output Characteristics**



**Transfer Characteristics**



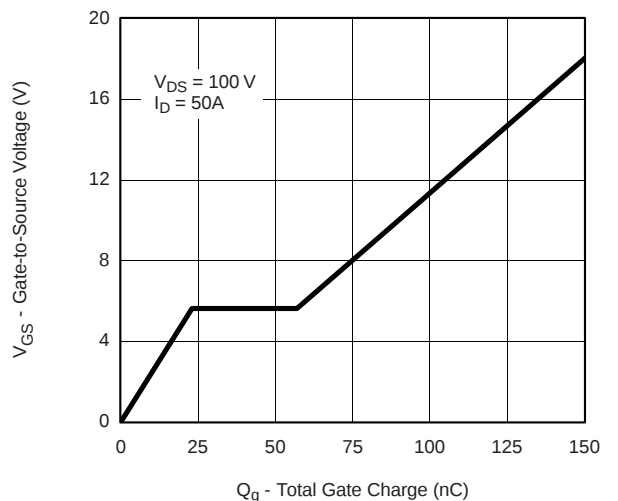
**Transconductance**



**On-Resistance vs. Drain Current**



**Capacitance**

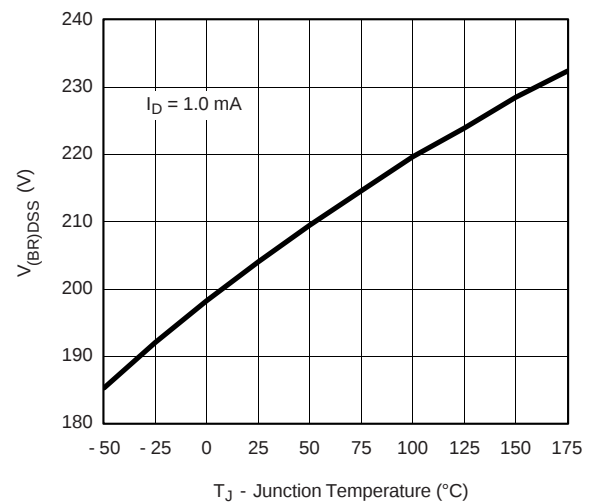


**Gate Charge**

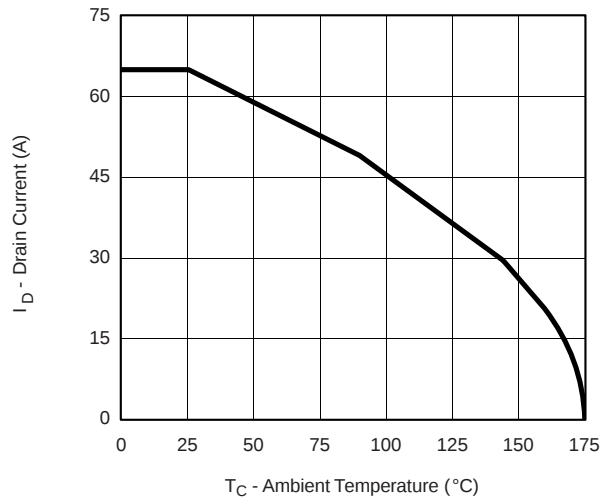
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted

**On-Resistance vs. Junction Temperature**

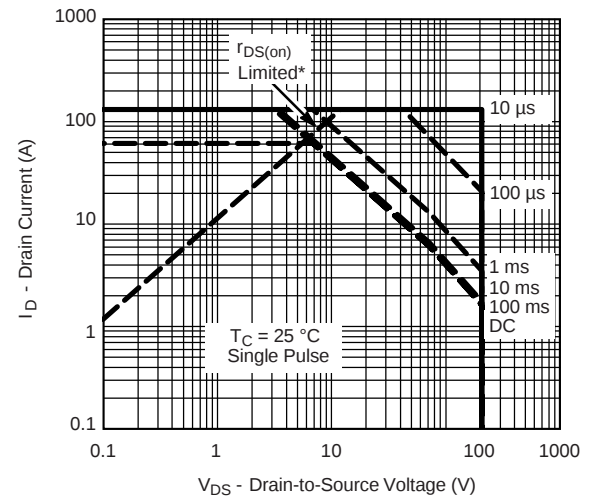
**Source-Drain Diode Forward Voltage**

**Avalanche Current vs. Time**

**Drain Source Breakdown vs. Junction Temperature**

## THERMAL RATINGS

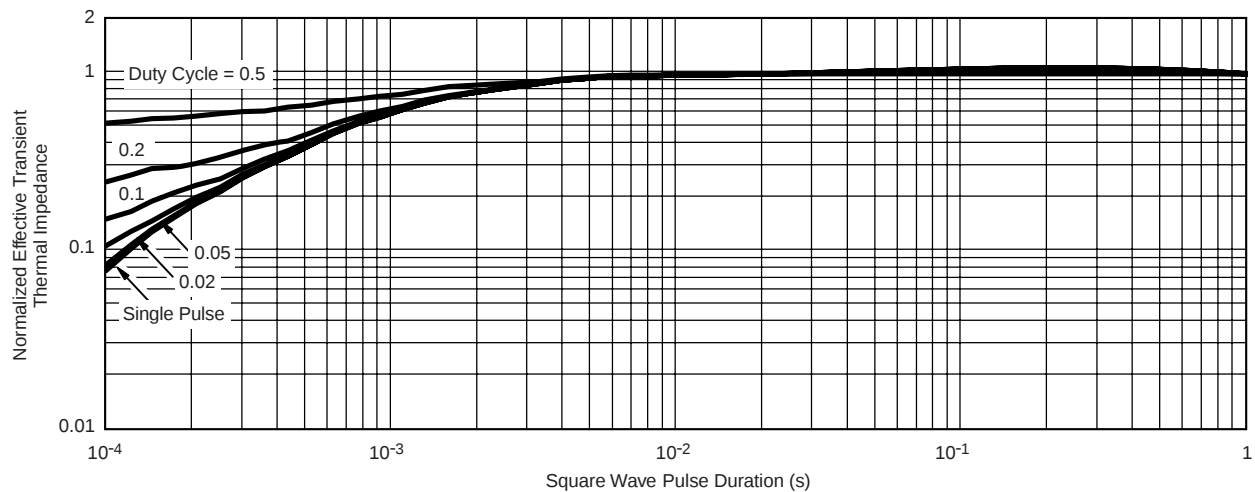


**Maximum Avalanche and Drain Current  
vs. Case Temperature**

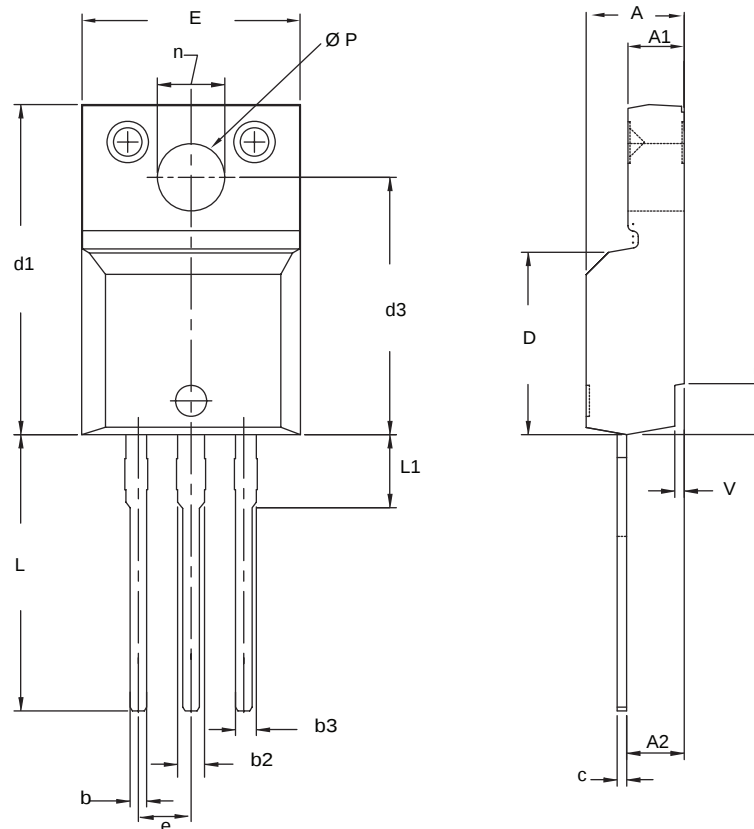


\*  $V_{GS}$  > minimum  $V_{GS}$  at which  $r_{DS(on)}$  is specified

**Safe Operating Area**



**Normalized Thermal Transient Impedance, Junction-to-Case**

**TO-220 FULLPAK (HIGH VOLTAGE)**

| DIM. | MILLIMETERS |        | INCHES    |       |
|------|-------------|--------|-----------|-------|
|      | MIN.        | MAX.   | MIN.      | MAX.  |
| A    | 4.570       | 4.830  | 0.180     | 0.190 |
| A1   | 2.570       | 2.830  | 0.101     | 0.111 |
| A2   | 2.510       | 2.850  | 0.099     | 0.112 |
| b    | 0.622       | 0.890  | 0.024     | 0.035 |
| b2   | 1.229       | 1.400  | 0.048     | 0.055 |
| b3   | 1.229       | 1.400  | 0.048     | 0.055 |
| c    | 0.440       | 0.629  | 0.017     | 0.025 |
| D    | 8.650       | 9.800  | 0.341     | 0.386 |
| d1   | 15.88       | 16.120 | 0.622     | 0.635 |
| d3   | 12.300      | 12.920 | 0.484     | 0.509 |
| E    | 10.360      | 10.630 | 0.408     | 0.419 |
| e    | 2.54 BSC    |        | 0.100 BSC |       |
| L    | 13.200      | 13.730 | 0.520     | 0.541 |
| L1   | 3.100       | 3.500  | 0.122     | 0.138 |
| n    | 6.050       | 6.150  | 0.238     | 0.242 |
| Ø P  | 3.050       | 3.450  | 0.120     | 0.136 |
| u    | 2.400       | 2.500  | 0.094     | 0.098 |
| v    | 0.400       | 0.500  | 0.016     | 0.020 |

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DWG: 5972

**Notes**

1. To be used only for process drawing.
2. These dimensions apply to all TO-220, FULLPAK leadframe versions 3 leads.
3. All critical dimensions should C meet  $C_{pk} > 1.33$ .
4. All dimensions include burrs and plating thickness.
5. No chipping or package damage.

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