

## 60V N-Channel Enhancement Mode MOSFET

**Description**

The PECN90N06FR uses advanced trench technology to provide excellent  $R_{DS(ON)}$  and low gate charge. It can be used in a wide variety of applications.

**General Features**

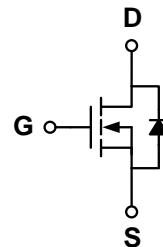
- ◆  $V_{DS} = 60V$   $I_D = 90A$   
 $R_{DS(ON)}(\text{Typ.}) = 6.2m\Omega$  @  $V_{GS} = 10V$
- ◆ High density cell design for ultra low  $R_{DSON}$
- ◆ Fully characterized avalanche voltage and current
- ◆ Good stability and uniformity with high  $E_{AS}$
- ◆ Excellent package for good heat dissipation
- ◆ Special process technology for high ESD capability

**Application***100% UIS TESTED!**100%  $\Delta V_{ds}$  TESTED!*

- ◆ Power switching application
- ◆ Hard switched and high frequency circuits
- ◆ Uninterruptible power supply

**Package**

- ◆ TO-220F

**Schematic diagram****Marking and pin assignment****TO-220F**

(Top View)

**Ordering Information**

| Part Number | Storage Temperature | Package | Devices Per Reel |
|-------------|---------------------|---------|------------------|
| PECN90N06FR | -55°C to +150°C     | TO-220F | —                |

**Absolute Maximum Ratings (TA=25°C unless otherwise noted)**

| parameter                            | symbol   | limit    | unit |
|--------------------------------------|----------|----------|------|
| Drain-source voltage                 | $V_{DS}$ | 60       | V    |
| Gate-source voltage                  | $V_{GS}$ | $\pm 20$ | V    |
| Continuous Drain Current<br>TC=25°C  | $I_D$    | 90       | A    |
| TC=100°C                             |          | 62       |      |
| Pulsed Drain Current                 | $I_{DP}$ | 310      | A    |
| Avalanche energy( L=0.5mH)           | $E_{AS}$ | 450      | mJ   |
| Maximum power dissipation            | $P_D$    | 160      | W    |
| Operating junction Temperature range | $T_j$    | -55—150  | °C   |

**Electrical Characteristics** (TA=25°C unless otherwise noted)

| Parameter                                     | Symbol              | Condition   | Min  | Typ  | Max  | Unit |
|---|---------------------|---|--|------|------|------|
| <b>Static Characteristics</b>                 |                     |   |  |      |      |      |
| Drain-source breakdown voltage                | BV <sub>DSS</sub>   | V <sub>GS</sub> =0V, I <sub>D</sub> =250μA                        | 60   | -    | -    | V    |
| Zero gate voltage drain current               | I <sub>DSS</sub>    | V <sub>DS</sub> =60V, GS=0V                                       | T <sub>J</sub> =25°C                       | -    | -    | 1    |
|   |                     |   | T <sub>J</sub> =85°C                       | -    | -    | 30   |
| Gate Leakage Current                          | I <sub>GSS</sub>    | V <sub>DS</sub> =0V, V <sub>GS</sub> =±20V                        | -  | -    | ±100 | nA   |
| Gate threshold voltage                        | V <sub>GS(th)</sub> | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA          | 1.0  | 1.4  | 2.5  | V    |
| Drain-source on-state resistance <sup>1</sup> | R <sub>DS(ON)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =45A                         | -  | 6.2  | 9    | mΩ   |
|   |                     |   | V <sub>GS</sub> =4.5V, I <sub>D</sub> =45A | -    | 7.8  | 10   |
| On Status Drain Current                       | I <sub>D(ON)</sub>  | V <sub>DS</sub> =60V, V <sub>GS</sub> =10V                        | 90   | -    | -    | A    |
| <b>Diode Characteristics</b>                  |                     |   |  |      |      |      |
| Diode Continuous Forward Current              | I <sub>S</sub>      |   | -  | -    | 90   | A    |
| Reverse Recovery Time                         | t <sub>rr</sub>     | I <sub>F</sub> =90A,<br>dI/dt=100A/us                             | -  | 33   | -    | ns   |
| Reverse Recovery Charge                       | Q <sub>rr</sub>     |   | -  | 54   | -    | nC   |
| <b>Dynamic Characteristics</b> <sup>2</sup>   |                     |   |  |      |      |      |
| Input capacitance                             | C <sub>ISS</sub>    | V <sub>GS</sub> =0V ,V <sub>DS</sub> =25V<br>f=1.0MHz             | -  | 3400 | -    | pF   |
| Output capacitance                            | C <sub>OSS</sub>    |   | -  | 300  | -    |      |
| Reverse transfer capacitance                  | C <sub>RSS</sub>    |   | -  | 215  | -    |      |
| Turn-on delay time                            | t <sub>D(ON)</sub>  | V <sub>GS</sub> =10V, V <sub>DD</sub> =30V, I <sub>D</sub> =30A   | -  | 15   | -    | ns   |
| Turn-on Rise time                             | tr                  |   | -  | 11   | -    |      |
| Turn-off delay time                           | t <sub>D(OFF)</sub> |   | -  | 52   | -    |      |
| Turn-off Fall time                            | tf                  |   | -  | 13   | -    |      |
| Total gate charge                             | Q <sub>g</sub>      | V <sub>GS</sub> =4.5V,I <sub>D</sub> =15A<br>V <sub>DS</sub> =15V | -  | 94   |      | nC   |
| Gate-source charge                            | Q <sub>gs</sub>     |   | -  | 16   |      |      |
| Gate-drain charge                             | Q <sub>gd</sub>     |   | -  | 24   | -    |      |
| <b>Drain-Source Diode Characteristics</b>     |                     |   |  |      |      |      |
| Diode forward voltage                         | V <sub>SD</sub>     | I <sub>SD</sub> =90A,V <sub>GS</sub> =0V                          | -  | 0.8  | 1.1  | V    |

Note: 1: Pulse test; pulse width  $\leq$  300ns, duty cycle  $\leq$  2%.

2: Guaranteed by design, not subject to production testing.

## Typical Performance Characteristics

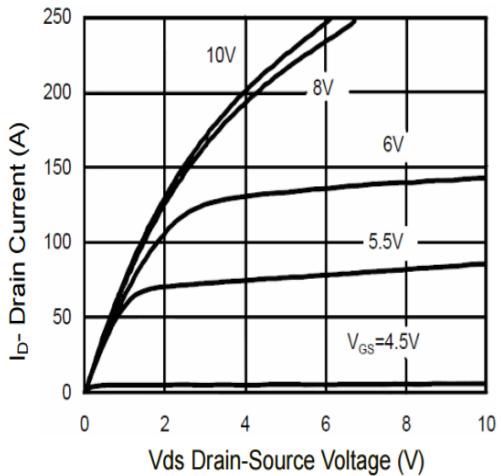


Figure 1 Output Characteristics

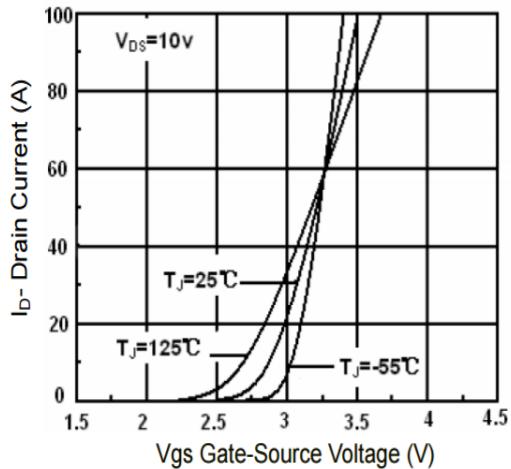


Figure 2 Transfer Characteristics

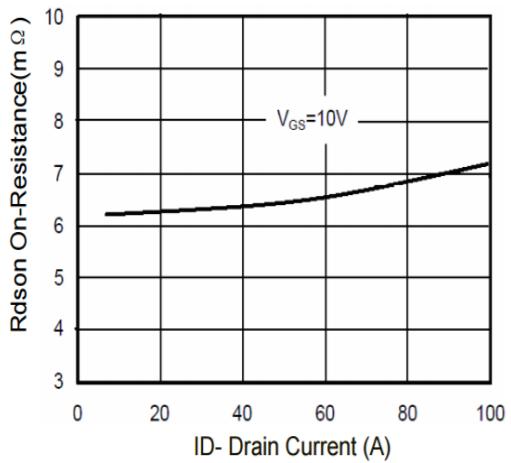


Figure 3 Rdson- Drain Current

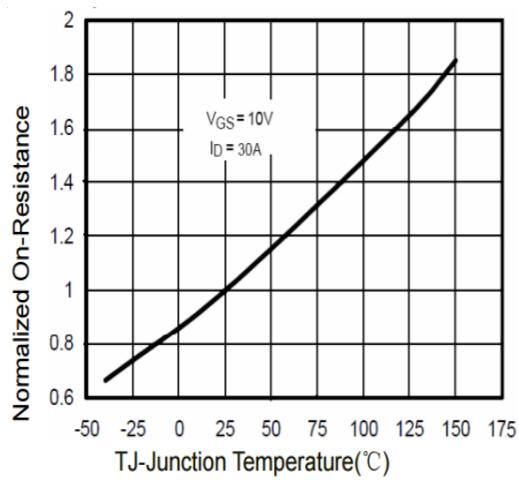


Figure 4 Rdson-JunctionTemperature

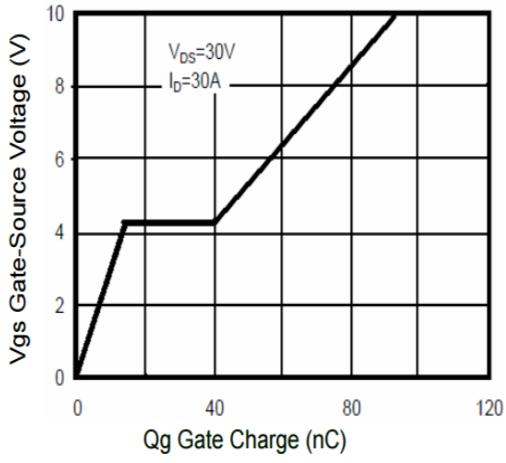


Figure 5 Gate Charge

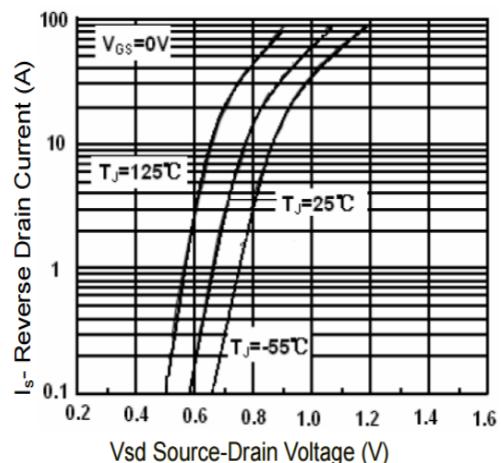
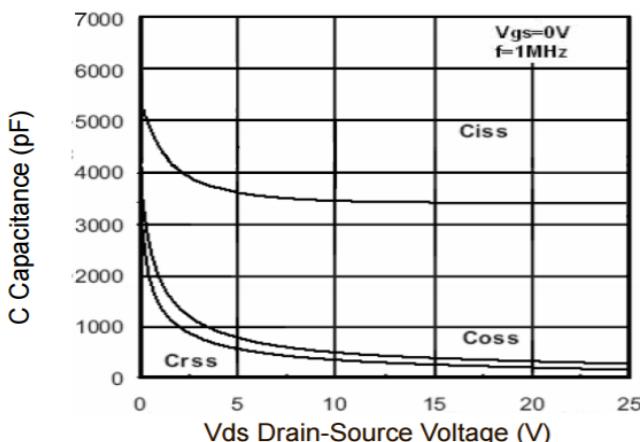
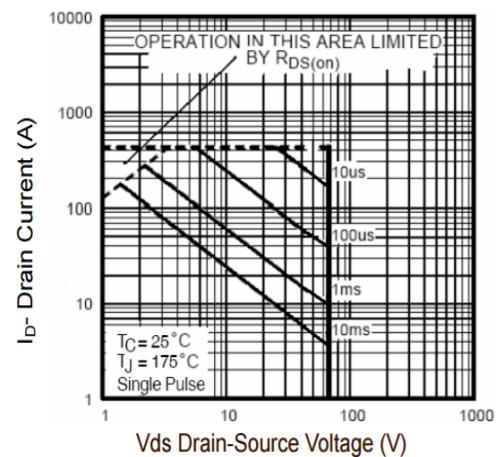


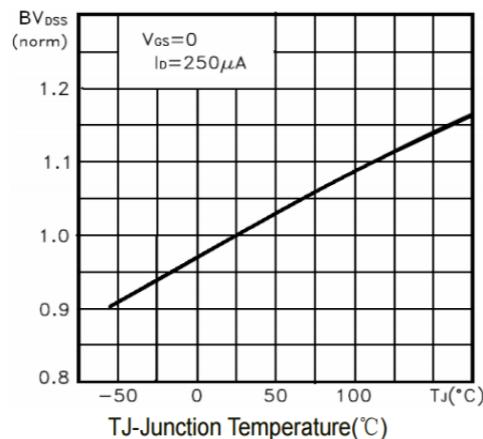
Figure 6 Source- Drain Diode Forward



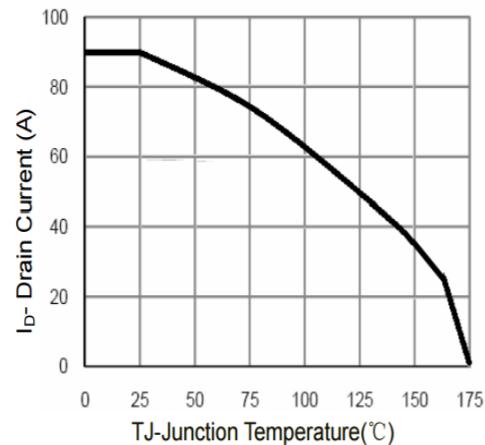
**Figure 7 Capacitance vs Vds**



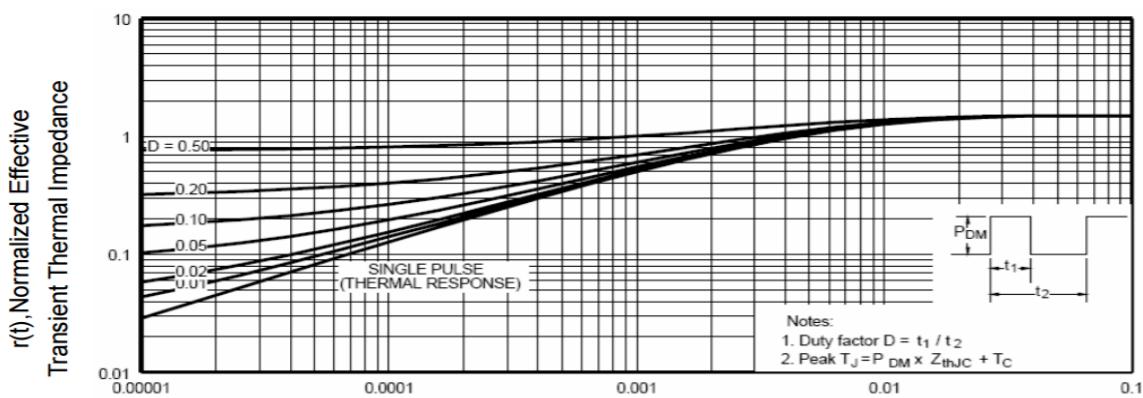
**Figure 8 Safe Operation Area**



**Figure 9  $BV_{DSS}$  vs Junction Temperature**

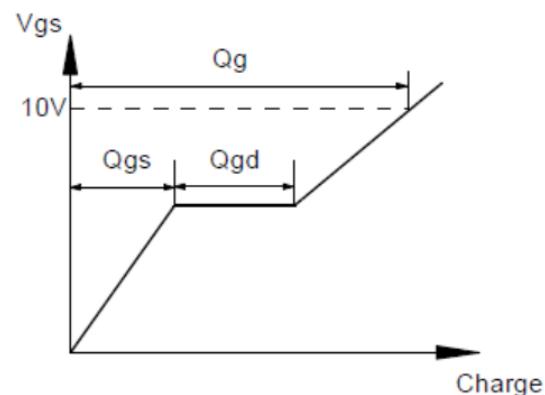
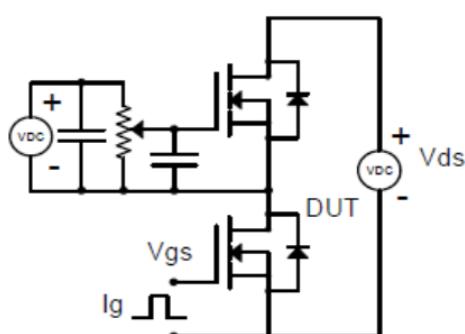


**Figure 10 Current vs Junction Temperature**

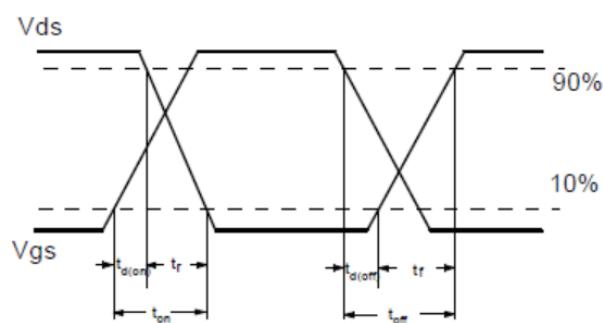
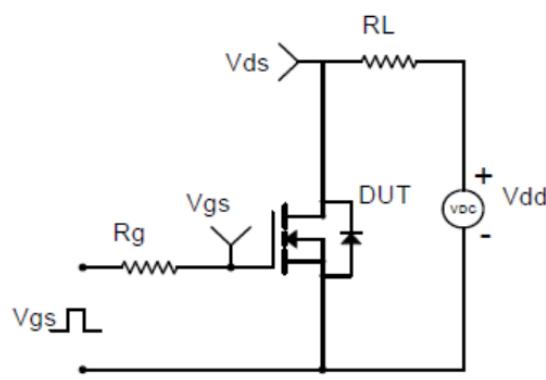


**Figure 11 Normalized Maximum Transient Thermal Impedance**

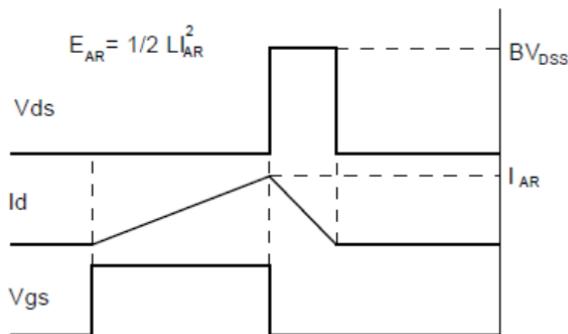
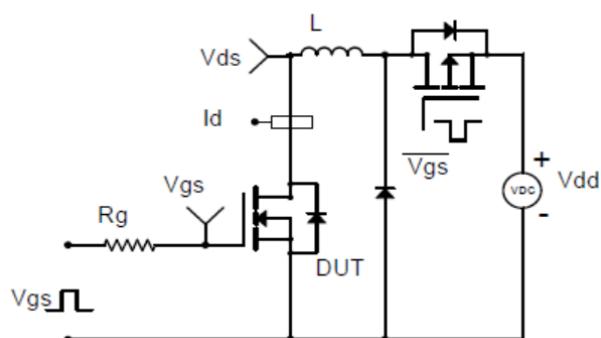
### Gate Charge Test Circuit & Waveform



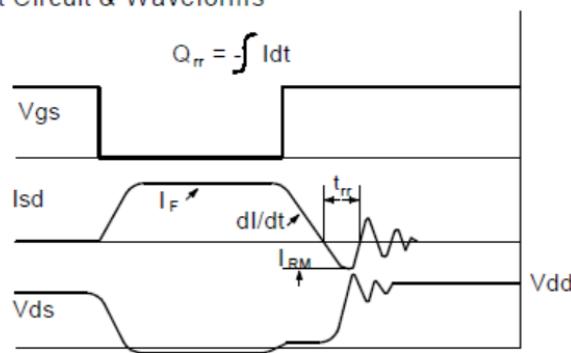
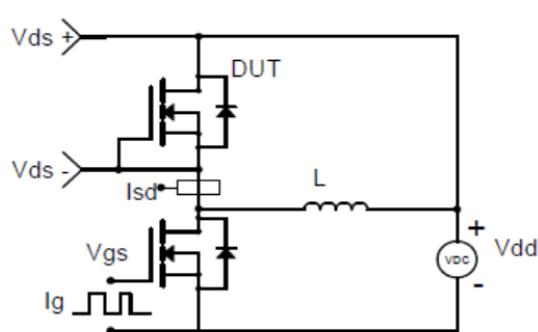
### Resistive Switching Test Circuit & Waveforms



### Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

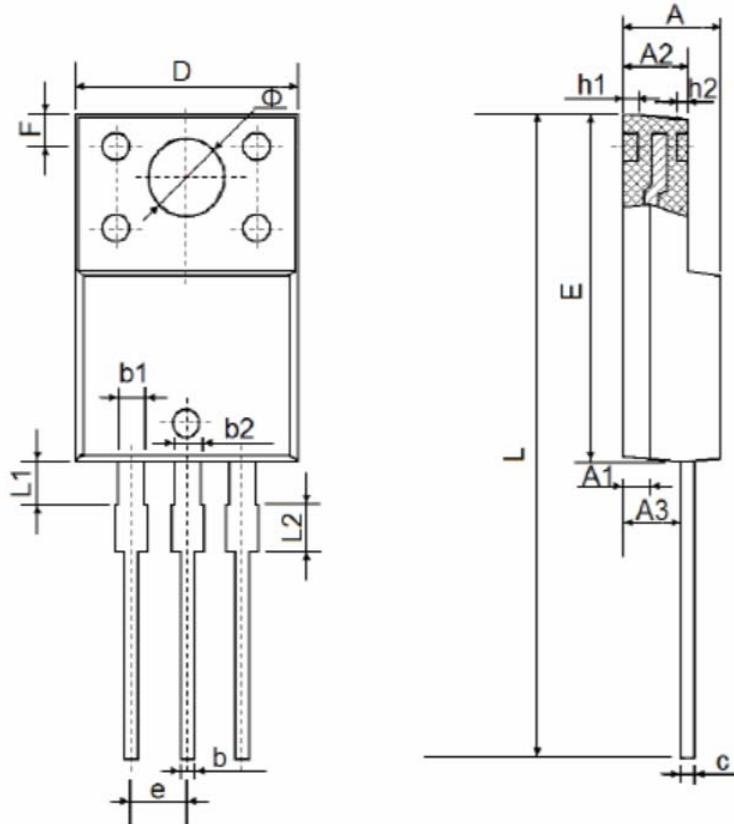


### Diode Recovery Test Circuit & Waveforms



## Package Information

- TO-220F



| Symbol | Dimensions In Millimeters |        | Dimensions In Inches |       |
|--------|---------------------------|--------|----------------------|-------|
|        | Min.                      | Max.   | Min.                 | Max.  |
| A      | 4.300                     | 4.700  | 0.169                | 0.185 |
| A1     | 1.300REF                  |        | 0.051REF             |       |
| A2     | 2.800                     | 3.200  | 0.110                | 0.126 |
| A3     | 2.500                     | 2.900  | 0.098                | 0.114 |
| b      | 0.500                     | 0.750  | 0.020                | 0.030 |
| b1     | 1.100                     | 1.350  | 0.043                | 0.053 |
| b2     | 1.500                     | 1.750  | 0.059                | 0.069 |
| c      | 0.500                     | 0.750  | 0.020                | 0.030 |
| D      | 9.960                     | 10.360 | 0.392                | 0.408 |
| E      | 14.800                    | 15.200 | 0.583                | 0.598 |
| e      | 2.540TYP.                 |        | 0.100TYP             |       |
| F      | 2.700REF                  |        | 0.106REF             |       |
| Φ      | 3.500REF                  |        | 0.138REF             |       |
| h1     | 0.800REF                  |        | 0.031REF             |       |
| h2     | 0.500REF                  |        | 0.020REF             |       |
| L      | 28.000                    | 28.400 | 1.102                | 1.118 |
| L1     | 1.700                     | 1.900  | 0.067                | 0.075 |
| L2     | 1.900                     | 2.100  | 0.075                | 0.083 |