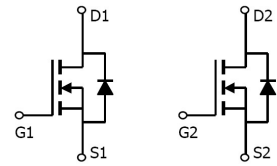


**Feature**

- 40V,20A  
 $R_{DS(ON)} < 15m\Omega @ V_{GS}=10V$  TYP:13 m $\Omega$   
 $R_{DS(ON)} < 20m\Omega @ V_{GS}=4.5V$  TYP:17 m $\Omega$
- Advanced Trench Technology
- Lead free product is acquired
- Excellent  $R_{DS(ON)}$  and Low Gate Charge



Schematic diagram

**Application**

- PWM applications
- Load Switch
- Power management



Marking and pin assignment

**Package Marking and Ordering Information**

| Device Marking | Device    | Device Package | Reel Size | Tape width | Quantity (PCS) |
|----------------|-----------|----------------|-----------|------------|----------------|
| 50N04QD        | AP50N04QD | PDFN3X3-8L     | 13 inch   | -          | 5000           |

**ABSOLUTE MAXIMUM RATINGS (T<sub>a</sub>=25°C unless otherwise noted)**

| Parameter   | Symbol           | Value     | Unit |
|---|------------------|-----------|------|
| Drain-Source Voltage                                    | V <sub>DS</sub>  | 40        | V    |
| Gate-Source Voltage                                     | V <sub>GS</sub>  | ±20       | V    |
| Continuous Drain Current (T <sub>a</sub> =25°C)         | I <sub>D</sub>   | 20        | A    |
| Continuous Drain Current (T <sub>a</sub> =100°C)        | I <sub>D</sub>   | 14        | A    |
| Pulsed Drain Current <sup>(1)</sup>                     | I <sub>DM</sub>  | 60        | A    |
| Singel Pulsed Avalanche Energy <sup>(2)</sup>           | E <sub>AS</sub>  | 12.25     | mJ   |
| Power Dissipation                                       | P <sub>D</sub>   | 35        | W    |
| Thermal Resistance from Junction to Case <sup>(4)</sup> | R <sub>θJC</sub> | 3.6       | °C/W |
| Junction Temperature                                    | T <sub>J</sub>   | 150       | °C   |
| Storage Temperature                                     | T <sub>STG</sub> | -55~ +150 | °C   |

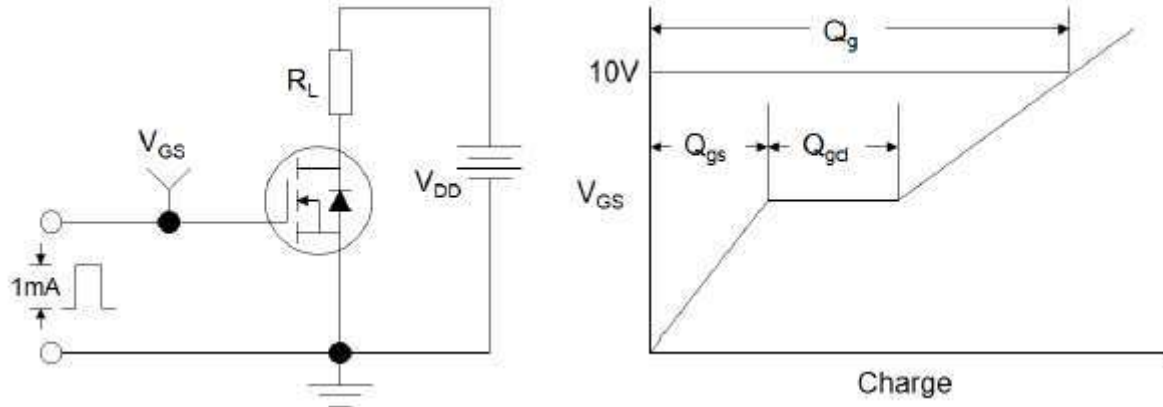
MOSFET ELECTRICAL CHARACTERISTICS( $T_a=25^{\circ}\text{C}$  unless otherwise noted)

| Parameter                                 | Symbol        | Test Condition   | Min | Type | Max       | Unit       |
|---|---------------|--|-----|------|-----------|------------|
| <b>Static Characteristics</b>             |               |  |     |      |           |            |
| Drain-source breakdown voltage            | $V_{(BR)DSS}$ | $V_{GS} = 0V, I_D = 250\mu A$  | 40  | -    | -         | V          |
| Zero gate voltage drain current           | $I_{DSS}$     | $V_{DS} = 40V, V_{GS} = 0V$  | -   | -    | 1         | $\mu A$    |
| Gate-body leakage current                 | $I_{GSS}$     | $V_{GS} = \pm 20V, V_{DS} = 0V$  | -   | -    | $\pm 100$ | nA         |
| Gate threshold voltage <sup>(3)</sup>     | $V_{GS(th)}$  | $V_{DS} = V_{GS}, I_D = 250\mu A$  | 1   | 1.5  | 2.5       | V          |
| Drain-source on-resistance <sup>(3)</sup> | $R_{DS(on)}$  | $V_{GS} = 10V, I_D = 10A$  | -   | 13   | 15        | m $\Omega$ |
|   |               | $V_{GS} = 4.5V, I_D = 8A$  | -   | 17   | 20        |            |
| <b>Dynamic characteristics</b>            |               |  |     |      |           |            |
| Input Capacitance                         | $C_{iss}$     | $V_{DS} = 20V, V_{GS} = 0V, f = 1MHz$                                    | -   | 1250 | -         | pF         |
| Output Capacitance                        | $C_{oss}$     |  | -   | 114  | -         |            |
| Reverse Transfer Capacitance              | $C_{rss}$     |  | -   | 85   | -         |            |
| <b>Switching characteristics</b>          |               |  |     |      |           |            |
| Turn-on delay time                        | $t_{d(on)}$   | $V_{DD} = 20V, I_D = 1A, R_L = 6\Omega$<br>$V_{GS} = 10V, R_G = 1\Omega$ | -   | 10   | -         | ns         |
| Turn-on rise time                         | $t_r$         |  | -   | 9    | -         |            |
| Turn-off delay time                       | $t_{d(off)}$  |  | -   | 32   | -         |            |
| Turn-off fall time                        | $t_f$         |  | -   | 16   | -         |            |
| Total Gate Charge                         | $Q_g$         | $V_{DS} = 20V, I_D = 10A,$<br>$V_{GS} = 10V$                             | -   | 20   | -         | nC         |
| Gate-Source Charge                        | $Q_{gs}$      |  | -   | 3.5  | -         |            |
| Gate-Drain Charge                         | $Q_{gd}$      |  | -   | 4.2  | -         |            |
| <b>Source-Drain Diode characteristics</b> |               |  |     |      |           |            |
| Diode Forward voltage <sup>(3)</sup>      | $V_{DS}$      | $V_{GS} = 0V, I_S = 10A$   | -   | -    | 1.2       | V          |
| Diode Forward current <sup>(4)</sup>      | $I_S$         |  | -   | -    | 20        | A          |

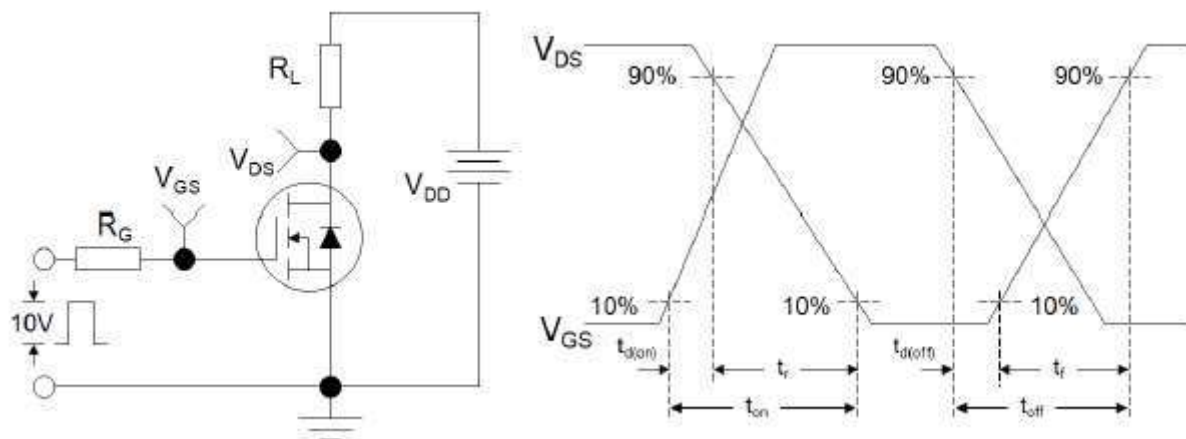
**Notes:**

1. Repetitive Rating: pulse width limited by maximum junction temperature
2. EAS Condition:  $T_J = 25^{\circ}\text{C}, V_{DD} = 20V, R_G = 25\Omega, L = 0.5mH$
3. Pulse Test: pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$
4. Surface Mounted on FR4 Board,  $t \leq 10$  sec

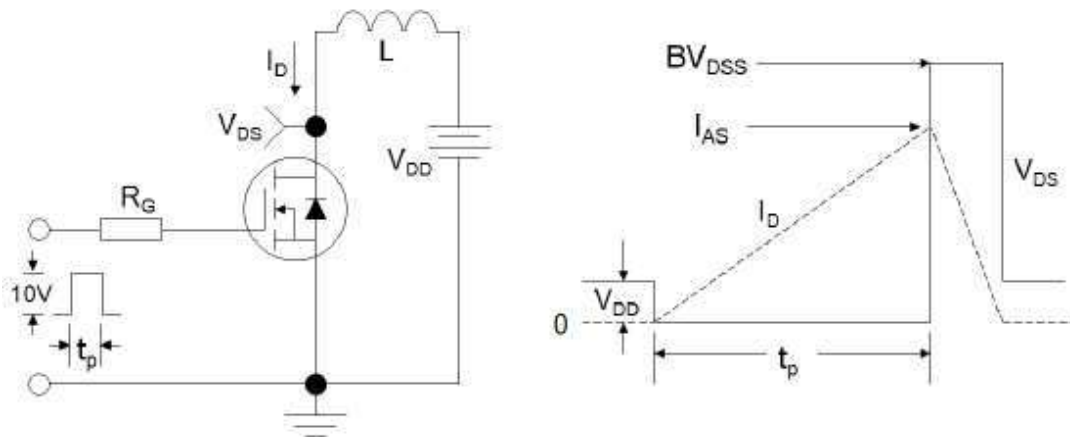
**Test Circuit**



**Figure 1: Gate Charge Test Circuit & Waveform**



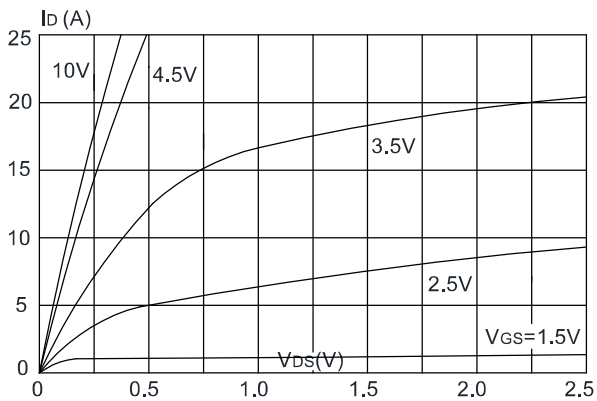
**Figure 2: Resistive Switching Test Circuit & Waveforms**



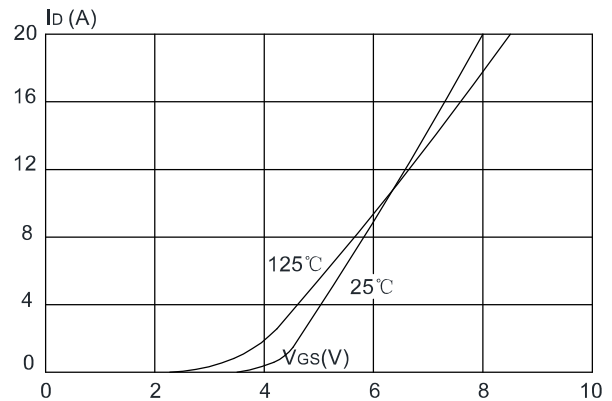
**Figure 3: Unclamped Inductive Switching Test Circuit & Waveforms**

**Typical Performance Characteristics**

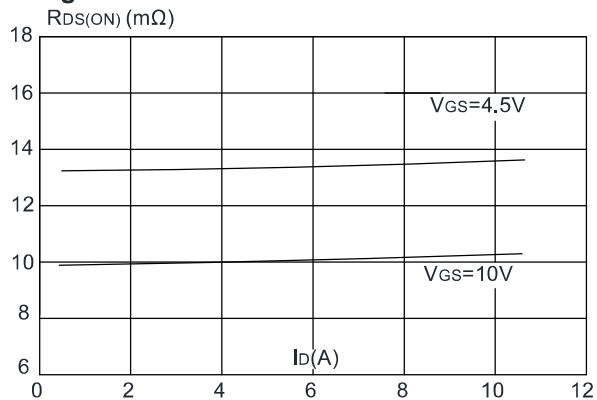
**Figure 1: Output Characteristics**



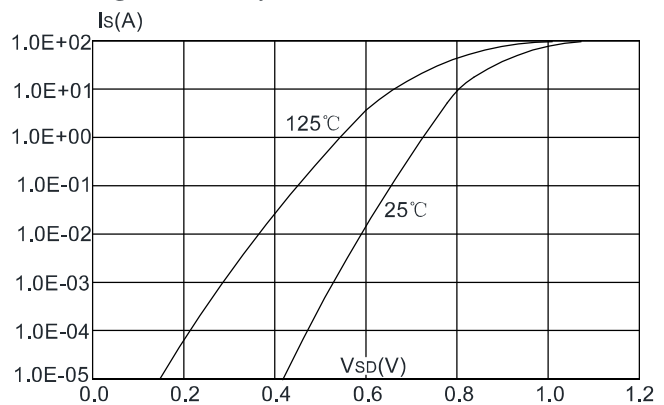
**Figure 2: Typical Transfer Characteristics**



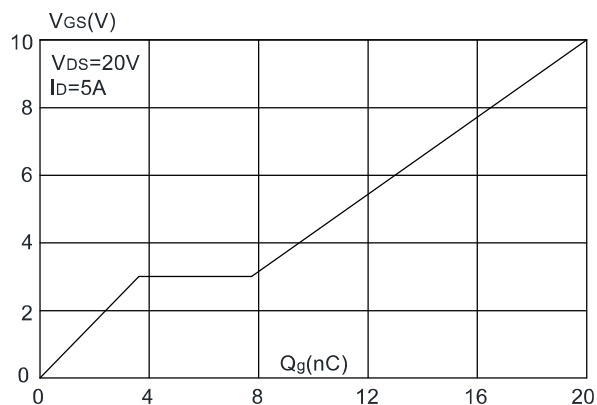
**Figure 3: On-resistance vs. Drain Current**



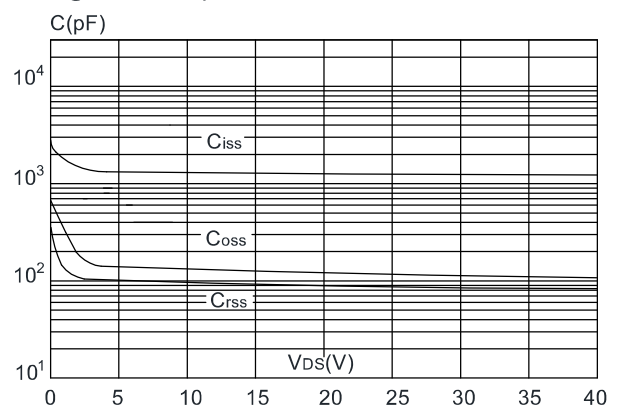
**Figure 4: Body Diode Characteristics**



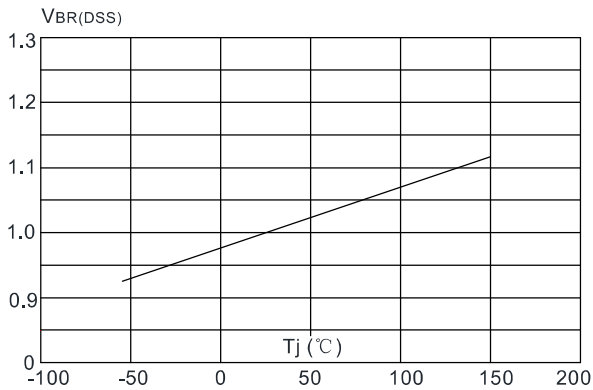
**Figure 5: Gate Charge Characteristics**



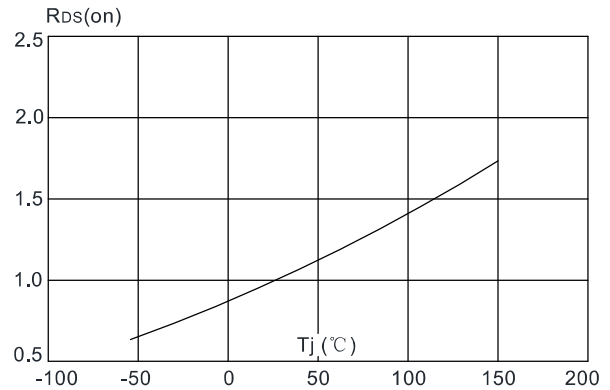
**Figure 6: Capacitance Characteristics**



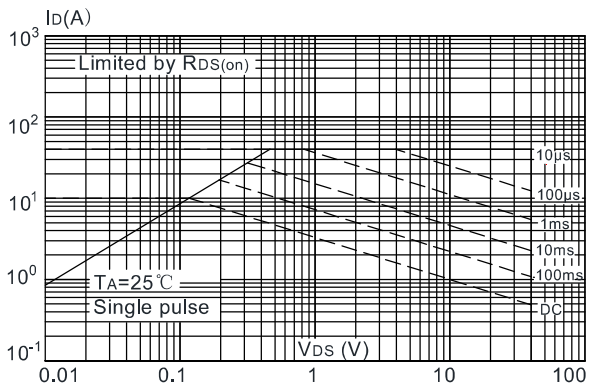
**Figure 7:** Normalized Breakdown Voltage vs. Junction Temperature



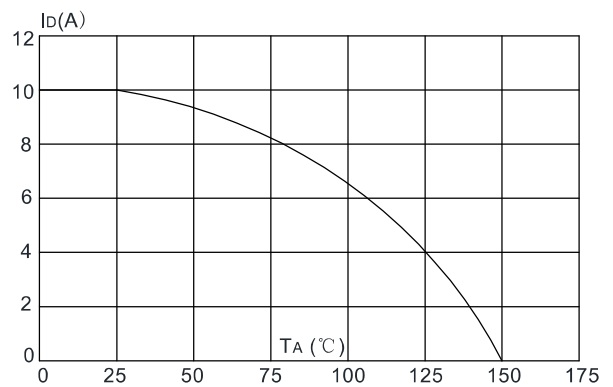
**Figure 8:** Normalized on Resistance vs. Junction Temperature



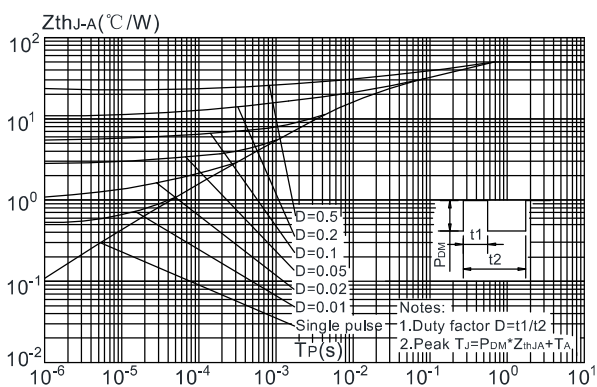
**Figure 9:** Maximum Safe Operating Area



**Figure 10:** Maximum Continuous Drain Current vs. Ambient Temperature



**Figure.11:** Maximum Effective Transient Thermal Impedance, Junction-to-Ambient



PDFN3X3-8L Package Information

