

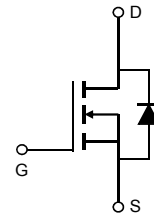
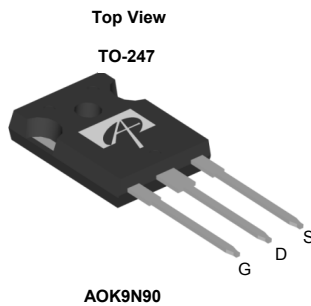
### General Description

The AOK9N90 is fabricated using an advanced high voltage MOSFET process that is designed to deliver high levels of performance and robustness in popular AC-DC applications. By providing low  $R_{DS(on)}$ ,  $C_{iss}$  and  $C_{rss}$  along with guaranteed avalanche capability this part can be adopted quickly into new and existing offline power supply designs.

### Product Summary

|                                 |            |
|---------------------------------|------------|
| $V_{DS}$                        | 1000@150°C |
| $I_D$ (at $V_{GS}=10V$ )        | 9A         |
| $R_{DS(ON)}$ (at $V_{GS}=10V$ ) | < 1.3Ω     |

100% UIS Tested  
 100%  $R_g$  Tested



### Absolute Maximum Ratings $T_A=25^\circ C$ unless otherwise noted

| Parameter  | Symbol         | AOK9N90           | Units |
|--|----------------|-------------------|-------|
| Drain-Source Voltage   | $V_{DS}$       | 900               | V     |
| Gate-Source Voltage  | $V_{GS}$       | ±30               | V     |
| Continuous Drain Current   | $I_D$          | $T_C=25^\circ C$  | 9     |
|  |                | $T_C=100^\circ C$ | 6     |
| Pulsed Drain Current <sup>C</sup>  | $I_{DM}$       | 34                | A     |
| Avalanche Current <sup>C</sup>   | $I_{AR}$       | 3.6               | A     |
| Repetitive avalanche energy <sup>C</sup>                                     | $E_{AR}$       | 194               | mJ    |
| Single plused avalanche energy <sup>G</sup>                                  | $E_{AS}$       | 388               | mJ    |
| Peak diode recovery dv/dt  | dv/dt          | 5                 | V/ns  |
| Power Dissipation <sup>B</sup>   | $P_D$          | $T_C=25^\circ C$  | 368   |
|  |                | Derate above 25°C | 2.9   |
| Junction and Storage Temperature Range                                       | $T_J, T_{STG}$ | -55 to 150        | °C    |
| Maximum lead temperature for soldering purpose, 1/8" from case for 5 seconds | $T_L$          | 300               | °C    |

### Thermal Characteristics

| Parameter                                  | Symbol          | AOK9N90 | Units |
|--|-----------------|---------|-------|
| Maximum Junction-to-Ambient <sup>A,D</sup> | $R_{\theta JA}$ | 40      | °C/W  |
| Maximum Case-to-sink <sup>A</sup>          | $R_{\theta CS}$ | 0.5     | °C/W  |
| Maximum Junction-to-Case                   | $R_{\theta JC}$ | 0.34    | °C/W  |

**Electrical Characteristics (T<sub>J</sub>=25°C unless otherwise noted)**

| Symbol                             | Parameter                                 | Conditions  | Min  | Typ  | Max  | Units |
|------------------------------------|---|---|--|------|------|-------|
| <b>STATIC PARAMETERS</b>           |   |   |  |      |      |       |
| BV <sub>DSS</sub>                  | Drain-Source Breakdown Voltage            | I <sub>D</sub> =250μA, V <sub>GS</sub> =0V, T <sub>J</sub> =25°C                        | 900  |      |      | V     |
|                                    |   | I <sub>D</sub> =250μA, V <sub>GS</sub> =0V, T <sub>J</sub> =150°C                       |  | 1000 |      |       |
| BV <sub>DSS</sub> /ΔT <sub>J</sub> | Breakdown Voltage Temperature Coefficient | I <sub>D</sub> =250μA, V <sub>GS</sub> =0V  |  | 0.9  |      | V/°C  |
| I <sub>DSS</sub>                   | Zero Gate Voltage Drain Current           | V <sub>DS</sub> =900V, V <sub>GS</sub> =0V  |  |      | 1    | μA    |
|                                    |   | V <sub>DS</sub> =720V, T <sub>J</sub> =125°C  |  |      | 10   |       |
| I <sub>GSS</sub>                   | Gate-Body leakage current                 | V <sub>DS</sub> =0V, V <sub>GS</sub> =±30V  |  |      | ±100 | nA    |
| V <sub>GS(th)</sub>                | Gate Threshold Voltage                    | V <sub>DS</sub> =5V, I <sub>D</sub> =250μA  | 3.4  | 4    | 4.5  | V     |
| R <sub>DS(ON)</sub>                | Static Drain-Source On-Resistance         | V <sub>GS</sub> =10V, I <sub>D</sub> =4.5A  |  | 1    | 1.3  | Ω     |
| g <sub>FS</sub>                    | Forward Transconductance                  | V <sub>DS</sub> =40V, I <sub>D</sub> =4.5A  |  | 13   |      | S     |
| V <sub>SD</sub>                    | Diode Forward Voltage                     | I <sub>S</sub> =1A, V <sub>GS</sub> =0V   |  | 0.7  | 1    | V     |
| I <sub>S</sub>                     | Maximum Body-Diode Continuous Current     |   |  |      | 9    | A     |
| I <sub>SM</sub>                    | Maximum Body-Diode Pulsed Current         |   |  |      | 34   | A     |
| <b>DYNAMIC PARAMETERS</b>          |   |   |  |      |      |       |
| C <sub>iss</sub>                   | Input Capacitance                         | V <sub>GS</sub> =0V, V <sub>DS</sub> =25V, f=1MHz                                       | 1700   | 2130 | 2560 | pF    |
| C <sub>oss</sub>                   | Output Capacitance                        |   | 100  | 152  | 200  | pF    |
| C <sub>rss</sub>                   | Reverse Transfer Capacitance              |   | 8  | 14   | 20   | pF    |
| R <sub>g</sub>                     | Gate resistance                           | V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz  | 0.6  | 1.3  | 2.0  | Ω     |
| <b>SWITCHING PARAMETERS</b>        |   |   |  |      |      |       |
| Q <sub>g</sub>                     | Total Gate Charge                         | V <sub>GS</sub> =10V, V <sub>DS</sub> =720V, I <sub>D</sub> =9A                         | 35   | 46   | 58   | nC    |
| Q <sub>gs</sub>                    | Gate Source Charge                        |   | 9.5  |      |      | nC    |
| Q <sub>gd</sub>                    | Gate Drain Charge                         |   | 20.5   |      |      | nC    |
| t <sub>D(on)</sub>                 | Turn-On DelayTime                         | V <sub>GS</sub> =10V, V <sub>DS</sub> =450V, I <sub>D</sub> =9A,<br>R <sub>G</sub> =25Ω |  | 45   |      | ns    |
| t <sub>r</sub>                     | Turn-On Rise Time                         |   |  | 80   |      | ns    |
| t <sub>D(off)</sub>                | Turn-Off DelayTime                        |   |  | 116  |      | ns    |
| t <sub>f</sub>                     | Turn-Off Fall Time                        |   |  | 60   |      | ns    |
| t <sub>rr</sub>                    | Body Diode Reverse Recovery Time          |   | I <sub>F</sub> =9A, dI/dt=100A/μs, V <sub>DS</sub> =100V | 450  | 568  | 690   |
| Q <sub>rr</sub>                    | Body Diode Reverse Recovery Charge        | I <sub>F</sub> =9A, dI/dt=100A/μs, V <sub>DS</sub> =100V                                | 6.0  | 7.8  | 10.0 | μC    |

A. The value of R<sub>θJA</sub> is measured with the device in a still air environment with T<sub>A</sub>=25° C.

B. The power dissipation P<sub>D</sub> is based on T<sub>J(MAX)</sub>=150° C, using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.

C. Repetitive rating, pulse width limited by junction temperature T<sub>J(MAX)</sub>=150° C. Ratings are based on low frequency and duty cycles to keep initial T<sub>J</sub>=25° C.

D. The R<sub>θJA</sub> is the sum of the thermal impedance from junction to case R<sub>θJC</sub> and case to ambient.

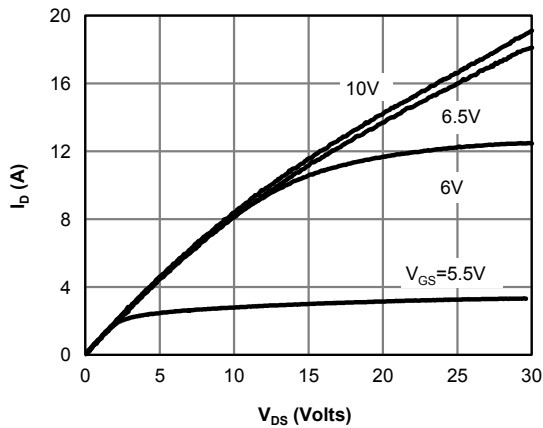
E. The static characteristics in Figures 1 to 6 are obtained using <300 μs pulses, duty cycle 0.5% max.

F. These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of T<sub>J(MAX)</sub>=150° C. The SOA curve provides a single pulse rating.

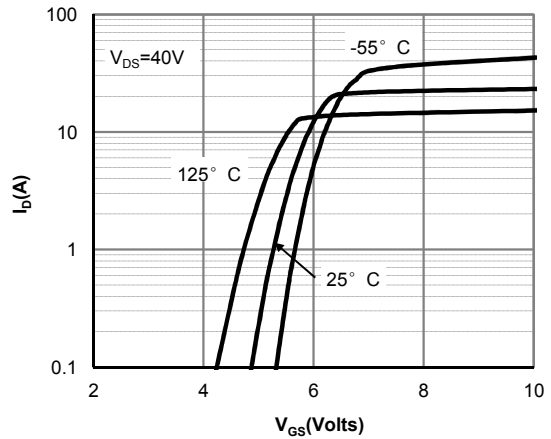
G. L=60mH, I<sub>AS</sub>=3.6A, V<sub>DD</sub>=150V, R<sub>G</sub>=25Ω, Starting T<sub>J</sub>=25° C

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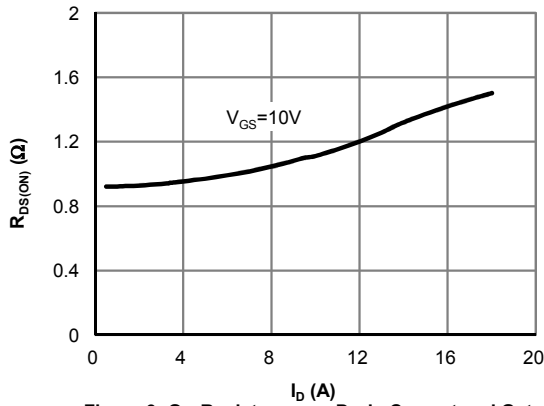
**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**



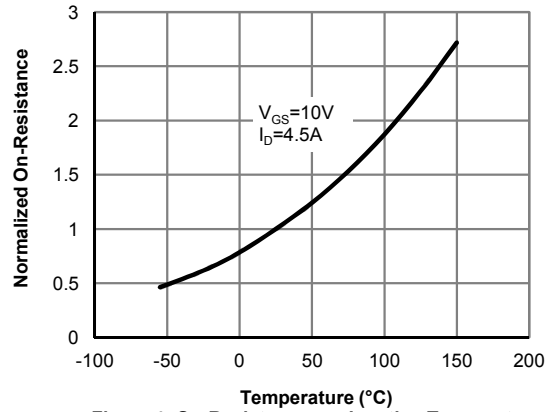
**Fig 1: On-Region Characteristics**



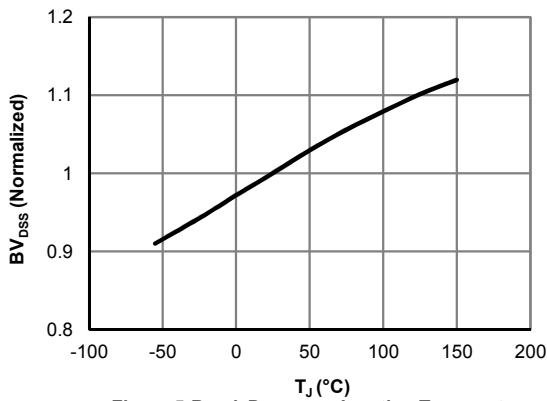
**Figure 2: Transfer Characteristics**



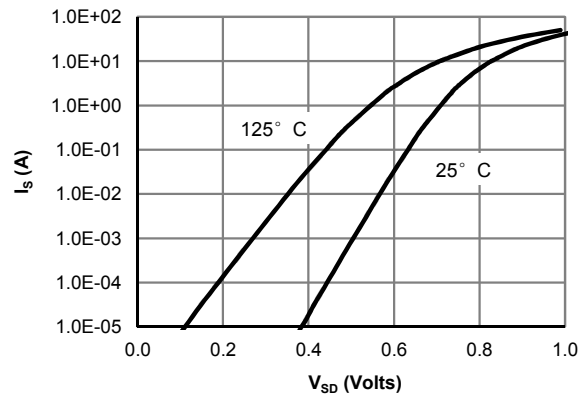
**Figure 3: On-Resistance vs. Drain Current and Gate Voltage**



**Figure 4: On-Resistance vs. Junction Temperature**

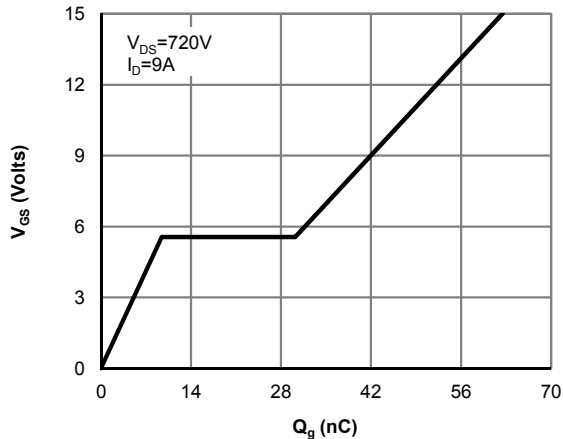


**Figure 5: Break Down vs. Junction Temperature**

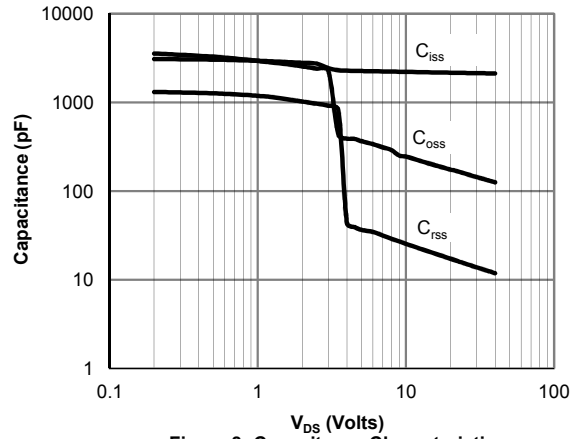


**Figure 6: Body-Diode Characteristics (Note E)**

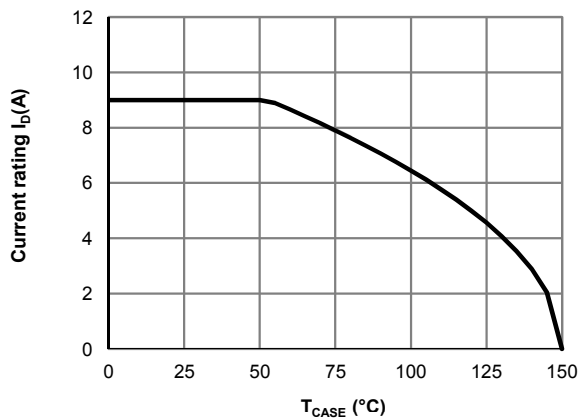
**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**



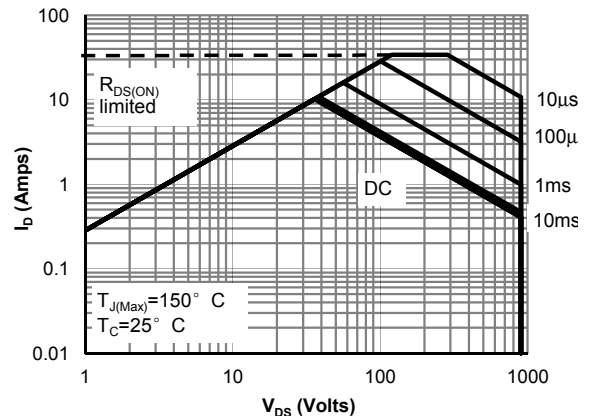
**Figure 7: Gate-Charge Characteristics**



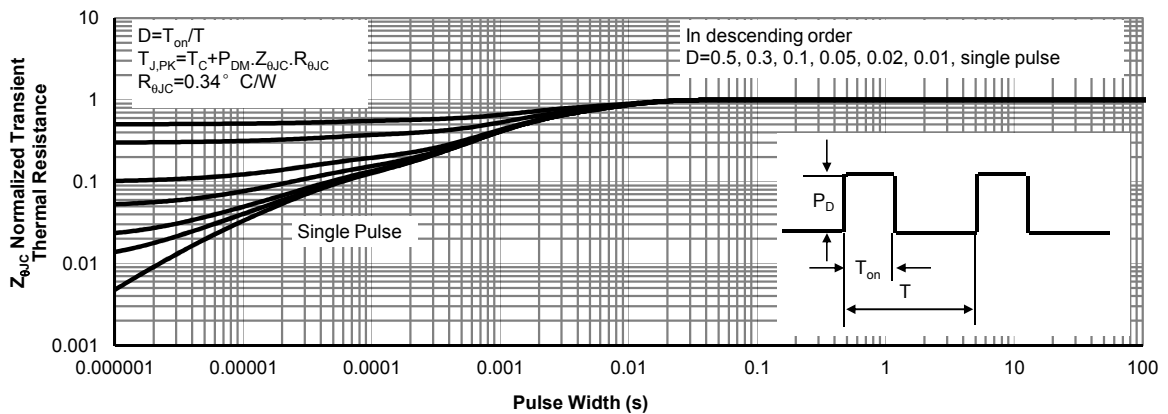
**Figure 8: Capacitance Characteristics**



**Figure 9: Current De-rating (Note B)**

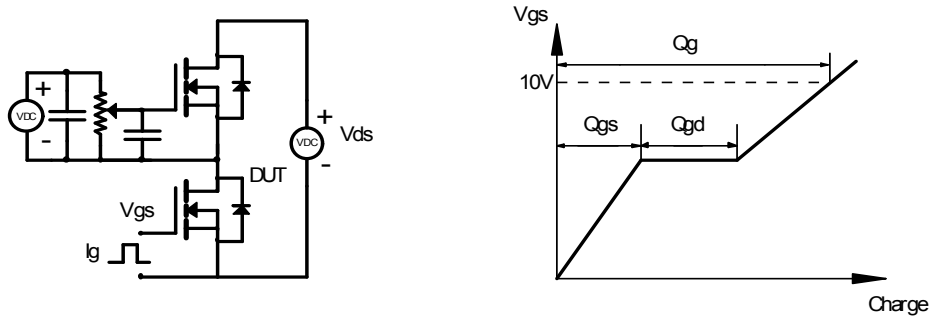


**Figure 10: Maximum Forward Biased Safe Operating Area for AOK9N90 (Note F)**

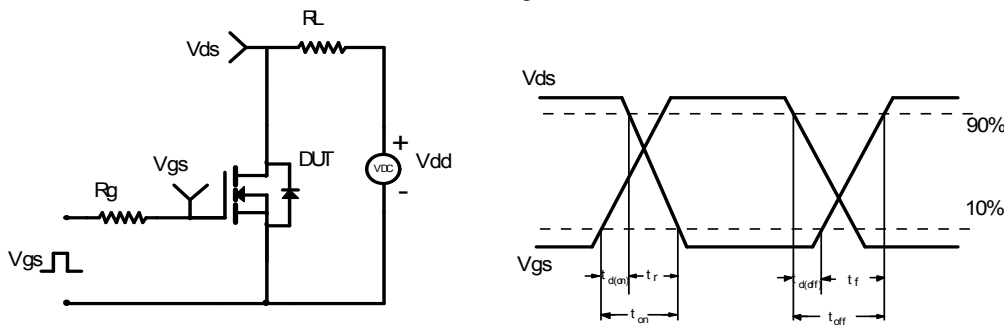


**Figure 11: Normalized Maximum Transient Thermal Impedance for AOK9N90 (Note F)**

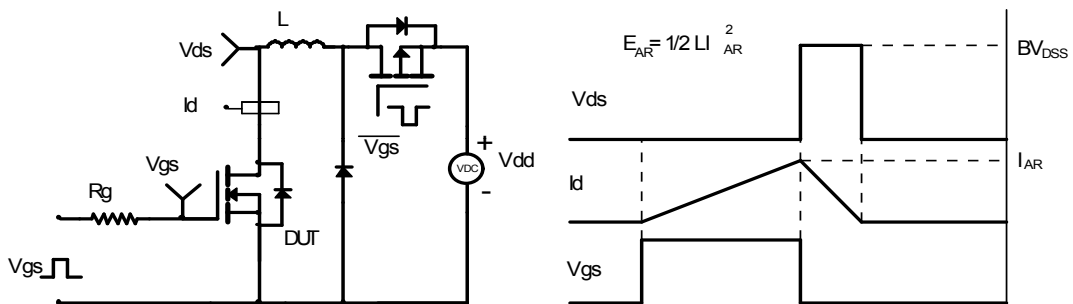
Gate Charge Test Circuit & Waveform



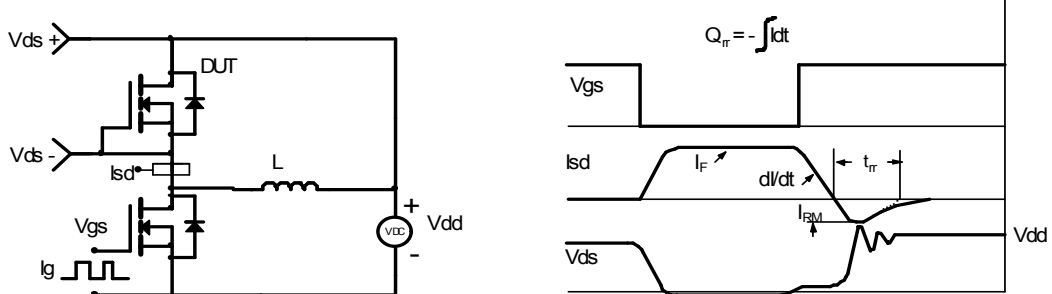
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



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