



THE DATASHEET OF AOD514



General Description

- Latest Trench Power MOSFET technology
- Very Low $R_{DS(on)}$ at 4.5V V_{GS}
- Low Gate Charge
- High Current Capability
- RoHS and Halogen-Free Compliant

Application

- DC/DC Converters in Computing
- Isolated DC/DC Converters in Telecom and Industrial

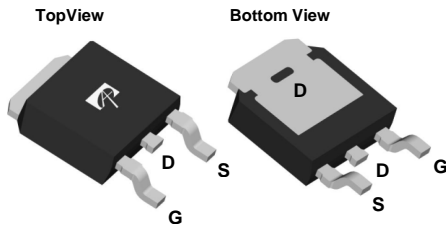
Product Summary

| | |
|------------------------------------|------------------|
| V_{DS} | 30V |
| I_D (at $V_{GS}=10V$) | 46A |
| $R_{DS(on)}$ (at $V_{GS}=10V$) | < 5.9m Ω |
| $R_{DS(on)}$ (at $V_{GS} = 4.5V$) | < 11.9m Ω |

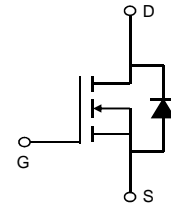
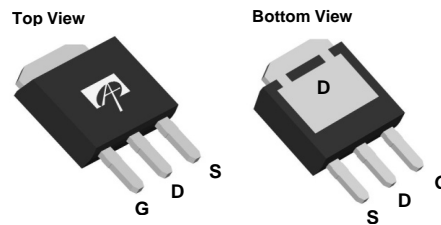
100% UIS Tested
 100% R_g Tested



TO252 DPAK: AOD514



TO251A IPAK: AOI514
 TO251B (IPAK short lead): AOY514



Absolute Maximum Ratings $T_A=25^\circ\text{C}$ unless otherwise noted

| Parameter | Symbol | Maximum | Units |
|------------------------------------------------|----------------|-------------------------|------------------|
| Drain-Source Voltage | V_{DS} | 30 | V |
| Gate-Source Voltage | V_{GS} | ± 20 | V |
| Continuous Drain Current ^G | I_D | $T_C=25^\circ\text{C}$ | 46 |
| | | $T_C=100^\circ\text{C}$ | 36 |
| Pulsed Drain Current ^C | I_{DM} | 163 | A |
| Continuous Drain Current | I_{DSM} | $T_A=25^\circ\text{C}$ | 17 |
| | | $T_A=70^\circ\text{C}$ | 13 |
| Avalanche Current ^C | I_{AS} | 25 | A |
| Avalanche energy $L=0.1\text{mH}$ ^C | E_{AS} | 31 | mJ |
| V_{DS} Spike | V_{SPIKE} | 36 | V |
| Power Dissipation ^B | P_D | $T_C=25^\circ\text{C}$ | 50 |
| | | $T_C=100^\circ\text{C}$ | 25 |
| Power Dissipation ^A | P_{DSM} | $T_A=25^\circ\text{C}$ | 2.5 |
| | | $T_A=70^\circ\text{C}$ | 1.6 |
| Junction and Storage Temperature Range | T_J, T_{STG} | -55 to 175 | $^\circ\text{C}$ |

Thermal Characteristics

| Parameter | Symbol | Typ | Max | Units |
|--------------------------------------------|-----------------|-----|-----|--------------------|
| Maximum Junction-to-Ambient ^A | $R_{\theta JA}$ | 16 | 20 | $^\circ\text{C/W}$ |
| Maximum Junction-to-Ambient ^{A D} | | 41 | 50 | $^\circ\text{C/W}$ |
| Maximum Junction-to-Case | $R_{\theta JC}$ | 2.5 | 3 | $^\circ\text{C/W}$ |

Electrical Characteristics (T_J=25°C unless otherwise noted)

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|-----------------------------|----------------------------------------------------|--------------------------------------------------------------------------------------------|-----|------|--------|-------|
| STATIC PARAMETERS | | | | | | |
| BV _{DSS} | Drain-Source Breakdown Voltage | I _D =250μA, V _{GS} =0V | 30 | | | V |
| I _{DSS} | Zero Gate Voltage Drain Current | V _{DS} =30V, V _{GS} =0V T _J =55°C | | | 1 5 | μA |
| I _{GSS} | Gate-Body leakage current | V _{DS} =0V, V _{GS} = ±20V | | | 100 | nA |
| V _{GS(th)} | Gate Threshold Voltage | V _{DS} =V _{GS} , I _D =250μA | 1.6 | 2 | 2.4 | V |
| R _{DS(ON)} | Static Drain-Source On-Resistance | V _{GS} =10V, I _D =20A T _J =125°C | | 4.3 | 5.9 | mΩ |
| | | V _{GS} =4.5V, I _D =20A | | 8.5 | 11.9 | |
| g _{FS} | Forward Transconductance | V _{DS} =5V, I _D =20A | | 91 | | S |
| V _{SD} | Diode Forward Voltage | I _S =1A, V _{GS} =0V | | 0.7 | 1 | V |
| I _S | Maximum Body-Diode Continuous Current ^G | | | | 46 | A |
| DYNAMIC PARAMETERS | | | | | | |
| C _{ISS} | Input Capacitance | V _{GS} =0V, V _{DS} =15V, f=1MHz | | 1187 | | pF |
| C _{OSS} | Output Capacitance | | | 483 | | pF |
| C _{RSS} | Reverse Transfer Capacitance | | | 60 | | pF |
| R _g | Gate resistance | V _{GS} =0V, V _{DS} =0V, f=1MHz | 0.7 | 1.5 | 2.3 | Ω |
| SWITCHING PARAMETERS | | | | | | |
| Q _g (10V) | Total Gate Charge | V _{GS} =10V, V _{DS} =15V, I _D =20A | | 18 | | nC |
| Q _g (4.5V) | Total Gate Charge | | | 8.8 | | nC |
| Q _{gs} | Gate Source Charge | | | 4.1 | | nC |
| Q _{gd} | Gate Drain Charge | | | 3.6 | | nC |
| t _{D(on)} | Turn-On Delay Time | V _{GS} =10V, V _{DS} =15V, R _L =0.75Ω, R _{GEN} =3Ω | | 7.3 | | ns |
| t _r | Turn-On Rise Time | | | 10.5 | | ns |
| t _{D(off)} | Turn-Off Delay Time | | | 21.8 | | ns |
| t _f | Turn-Off Fall Time | | | 5 | | ns |
| t _{rr} | Body Diode Reverse Recovery Time | I _F =20A, dI/dt=500A/μs | | 14.7 | | ns |
| Q _{rr} | Body Diode Reverse Recovery Charge | I _F =20A, dI/dt=500A/μs | | 24 | | nC |

- A. The value of R_{θJA} is measured with the device mounted on 1in² FR-4 board with 2oz. Copper, in a still air environment with T_A=25° C. The Power dissipation P_{DSM} is based on R_{θJA} and the maximum allowed junction temperature of 150° C. The value in any given application depends on the user's specific board design, and the maximum temperature of 175° C may be used if the PCB allows it.
- B. The power dissipation P_D is based on T_{J(MAX)}=175° 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. Single pulse width limited by junction temperature T_{J(MAX)}=175° C.
- D. The R_{θJA} is the sum of the thermal impedance from junction to case R_{θJC} and case to ambient.
- E. The static characteristics in Figures 1 to 6 are obtained using <300μs 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_{J(MAX)}=175° C. The SOA curve provides a single pulse rating.
- G. The maximum current rating is package limited.
- H. These tests are performed with the device mounted on 1 in² FR-4 board with 2oz. Copper, in a still air environment with T_A=25° C.

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

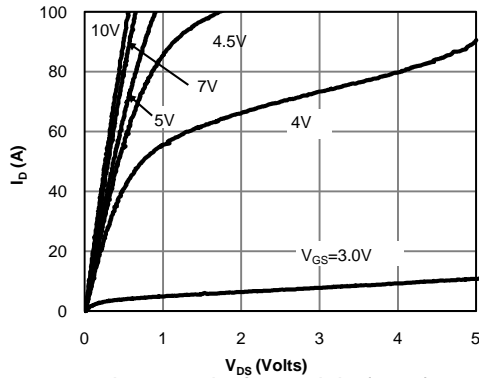


Fig 1: On-Region Characteristics (Note E)

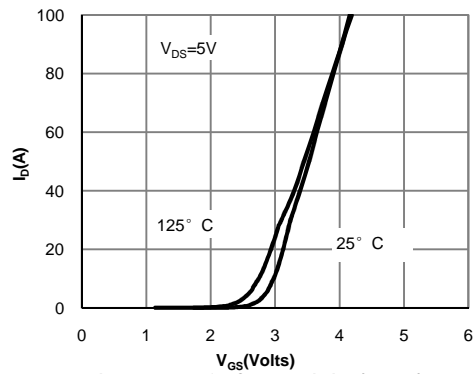


Figure 2: Transfer Characteristics (Note E)

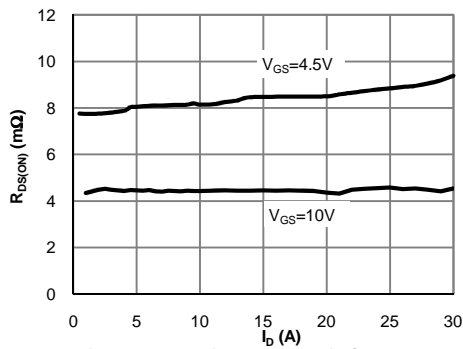


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

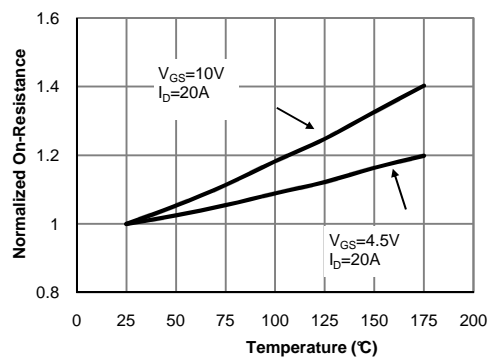


Figure 4: On-Resistance vs. Junction Temperature (Note E)

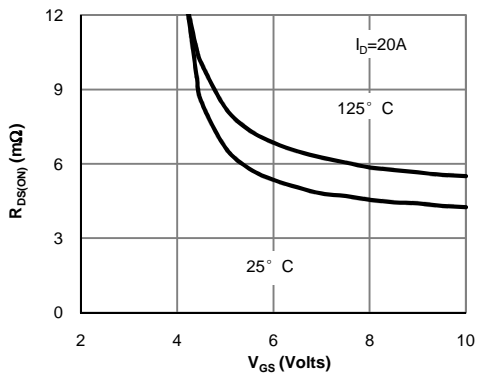


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

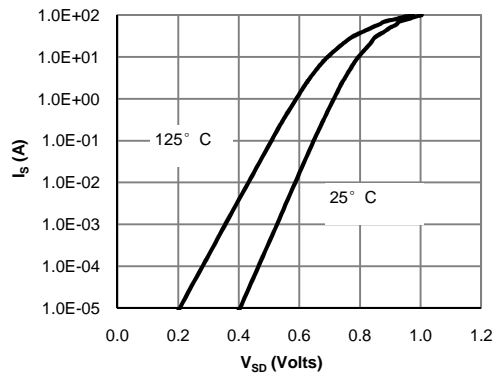


Figure 6: Body-Diode Characteristics (Note E)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

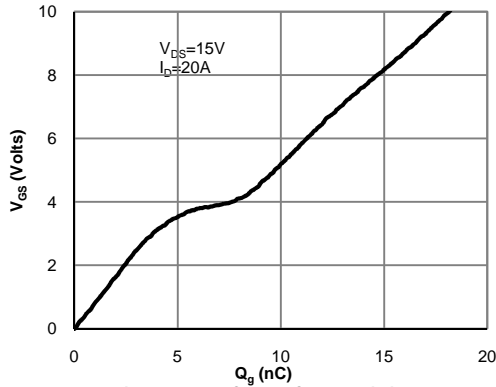


Figure 7: Gate-Charge Characteristics

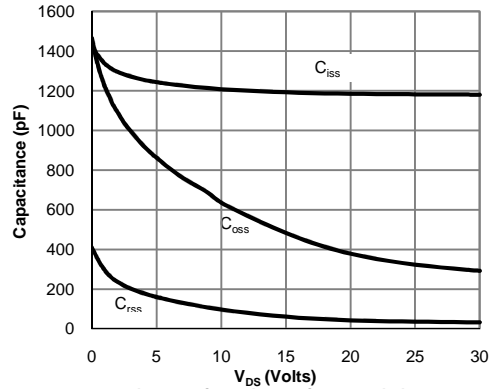


Figure 8: Capacitance Characteristics

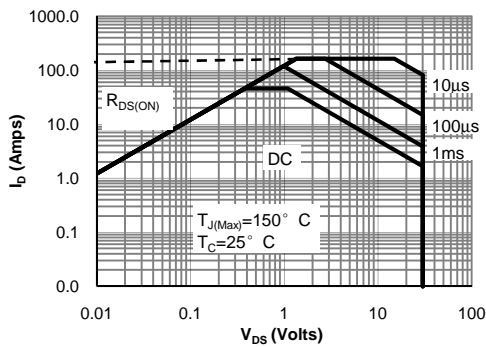


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

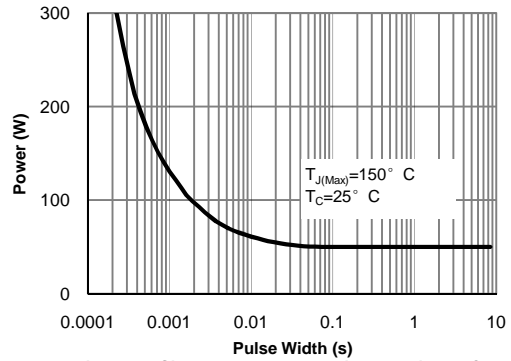


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

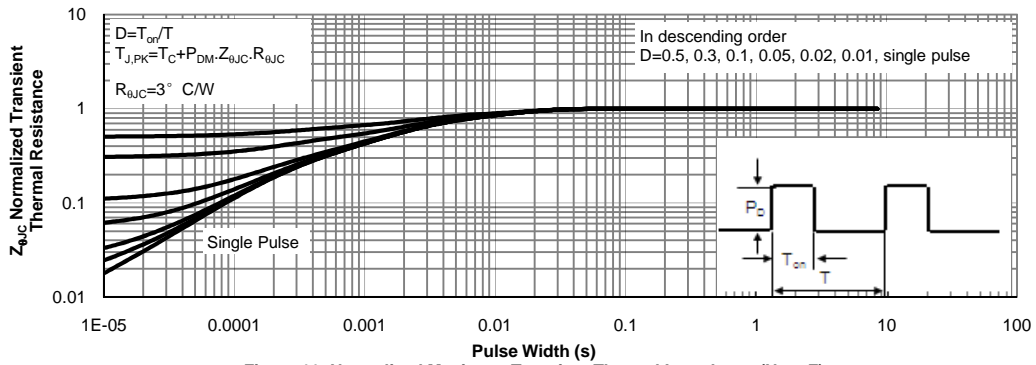


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

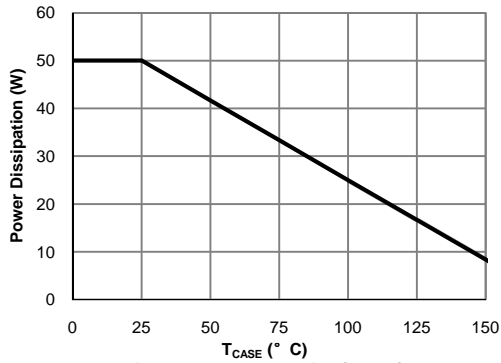


Figure 12: Power De-rating (Note F)

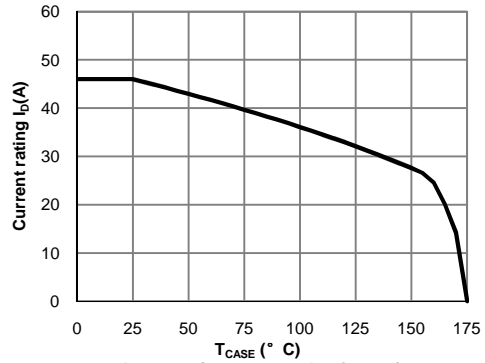


Figure 13: Current De-rating (Note F)

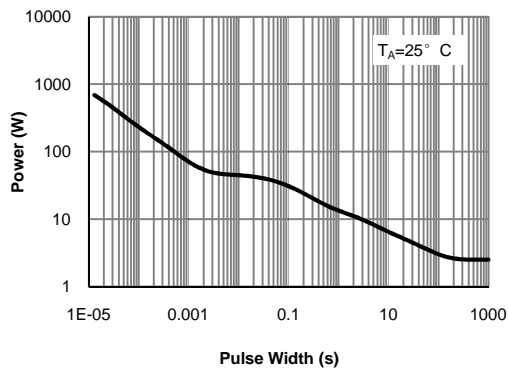


Figure 14: Single Pulse Power Rating Junction-to-Ambient (Note H)

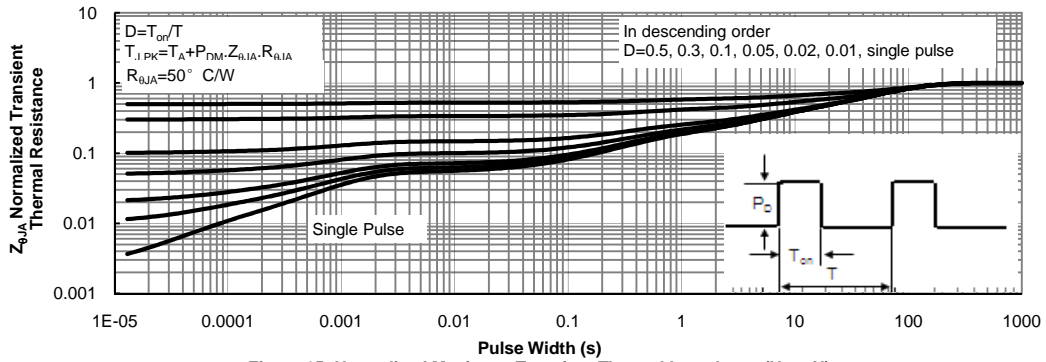
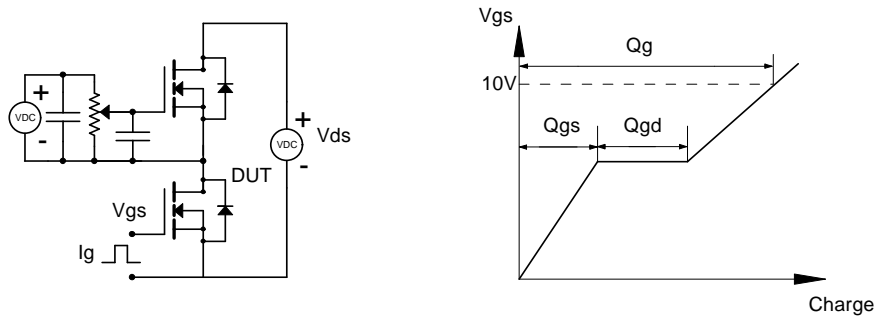
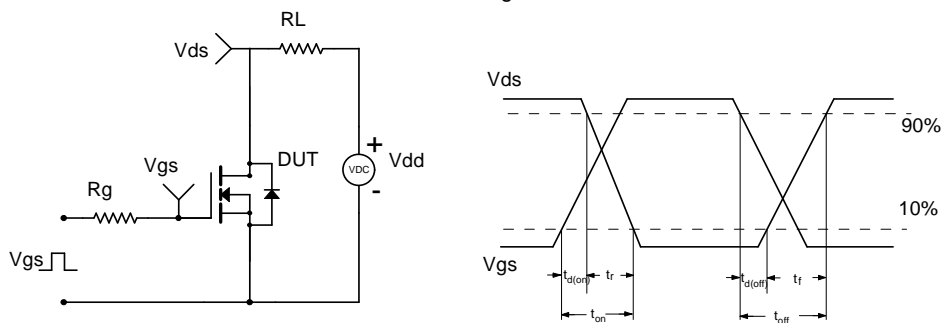


Figure 15: Normalized Maximum Transient Thermal Impedance (Note H)

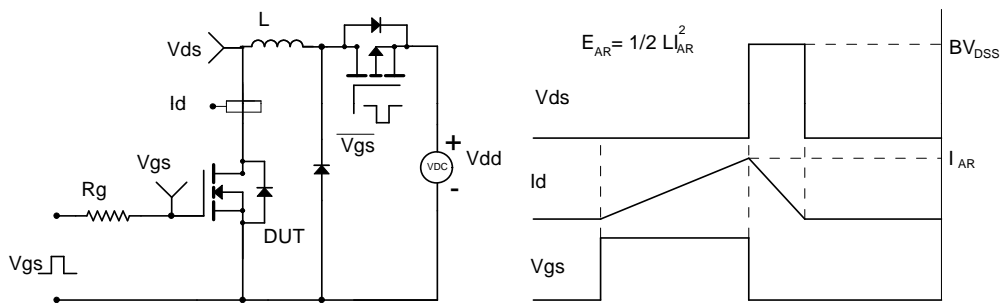
Gate Charge Test Circuit & Waveform



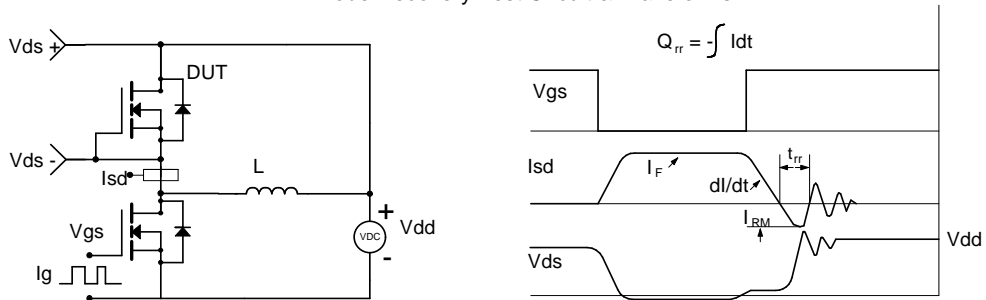
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



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