



**ALPHA & OMEGA**  
SEMICONDUCTOR

**AO4414**

**N-Channel Enhancement Mode Field Effect Transistor**

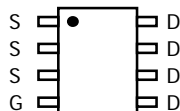


### General Description

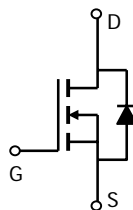
The AO4414 uses advanced trench technology to provide excellent  $R_{DS(ON)}$  and low gate charge. This device is suitable for use as a load switch or in PWM applications. The source leads are separated to allow a Kelvin connection to the source, which may be used to bypass the source inductance. *Standard Product AO4414 is Pb-free (meets ROHS & Sony 259 specifications). AO4414L is a Green Product ordering option. AO4414 and AO4414L are electrically identical.*

### Features

$V_{DS} (V) = 30V$   
 $I_D = 8.5A (V_{GS} = 10V)$   
 $R_{DS(ON)} < 26m\Omega (V_{GS} = 10V)$   
 $R_{DS(ON)} < 40m\Omega (V_{GS} = 4.5V)$



**SOIC-8**



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

| Parameter                              | Symbol         | Maximum    | Units      |
|--|----------------|------------|------------|
| Drain-Source Voltage                   | $V_{DS}$       | 30         | V          |
| Gate-Source Voltage                    | $V_{GS}$       | $\pm 20$   | V          |
| Continuous Drain Current <sup>A</sup>  | $I_D$          | 8.5        | A          |
|  |                | 7.1        |            |
| Pulsed Drain Current <sup>B</sup>      | $I_{DM}$       | 50         |            |
| Power Dissipation                      | $P_D$          | 3          | W          |
|  |                | 2.1        |            |
| Junction and Storage Temperature Range | $T_J, T_{STG}$ | -55 to 150 | $^\circ C$ |

### Thermal Characteristics

| Parameter                                | Symbol          | Typ | Max | Units        |
|--|-----------------|-----|-----|--------------|
| Maximum Junction-to-Ambient <sup>A</sup> | $R_{\theta JA}$ | 31  | 40  | $^\circ C/W$ |
| Maximum Junction-to-Ambient <sup>A</sup> |                 | 59  | 75  | $^\circ C/W$ |
| Maximum Junction-to-Lead <sup>C</sup>    | $R_{\theta JL}$ | 16  | 24  | $^\circ C/W$ |

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  | 30  |            |          | V     |
| I <sub>DSS</sub>            | Zero Gate Voltage Drain Current       | V <sub>DS</sub> =24V, V <sub>GS</sub> =0V<br>T <sub>J</sub> =55°C                         |     | 0.004      | 1<br>5   | μA    |
| I <sub>GSS</sub>            | Gate-Body leakage current             | V <sub>DS</sub> =0V, V <sub>GS</sub> = ±20V   |     |            | 100      | nA    |
| V <sub>GS(th)</sub>         | Gate Threshold Voltage                | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                                  | 1   | 1.9        | 3        | V     |
| I <sub>D(ON)</sub>          | On state drain current                | V <sub>GS</sub> =4.5V, V <sub>DS</sub> =5V  | 20  |            |          | A     |
| R <sub>DS(ON)</sub>         | Static Drain-Source On-Resistance     | V <sub>GS</sub> =10V, I <sub>D</sub> =8.5A<br>T <sub>J</sub> =125°C                       |     | 20<br>29.2 | 26<br>38 | mΩ    |
|                             |                                       | V <sub>GS</sub> =4.5V, I <sub>D</sub> =5A   |     | 31         | 40       | mΩ    |
|                             |                                       |   |     |            |          |       |
| g <sub>FS</sub>             | Forward Transconductance              | V <sub>DS</sub> =5V, I <sub>D</sub> =5A   | 10  | 17         |          | S     |
| V <sub>SD</sub>             | Diode Forward Voltage                 | I <sub>S</sub> =1A, V <sub>GS</sub> =0V   |     | 0.76       | 1        | V     |
| I <sub>S</sub>              | Maximum Body-Diode Continuous Current |   |     |            | 4.3      | A     |
| <b>DYNAMIC PARAMETERS</b>   |                                       |   |     |            |          |       |
| C <sub>iss</sub>            | Input Capacitance                     | V <sub>GS</sub> =0V, V <sub>DS</sub> =15V, f=1MHz   |     | 680        | 820      | pF    |
| C <sub>oss</sub>            | Output Capacitance                    |   |     | 102        |          | pF    |
| C <sub>rss</sub>            | Reverse Transfer Capacitance          |   |     | 77         |          | pF    |
| R <sub>g</sub>              | Gate resistance                       | V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz  |     | 3          | 3.6      | Ω     |
| <b>SWITCHING PARAMETERS</b> |                                       |   |     |            |          |       |
| Q <sub>g</sub> (10V)        | Total Gate Charge                     | V <sub>GS</sub> =10V, V <sub>DS</sub> =15V, I <sub>D</sub> =8.5A                          |     | 13.84      | 17       | nC    |
| Q <sub>g</sub> (4.5V)       | Total Gate Charge                     |   |     | 6.74       | 8.1      | nC    |
| Q <sub>gs</sub>             | Gate Source Charge                    |   |     | 1.84       |          | nC    |
| Q <sub>gd</sub>             | Gate Drain Charge                     |   |     | 3.32       |          | nC    |
| t <sub>D(on)</sub>          | Turn-On DelayTime                     | V <sub>GS</sub> =10V, V <sub>DS</sub> =15V, R <sub>L</sub> =1.8Ω,<br>R <sub>GEN</sub> =3Ω |     | 4.5        | 6.5      | ns    |
| t <sub>r</sub>              | Turn-On Rise Time                     |   |     | 4.2        | 6.3      | ns    |
| t <sub>D(off)</sub>         | Turn-Off DelayTime                    |   |     | 20.1       | 30       | ns    |
| t <sub>f</sub>              | Turn-Off Fall Time                    |   |     | 4.9        | 7.5      | ns    |
| t <sub>rr</sub>             | Body Diode Reverse Recovery Time      | I <sub>F</sub> =8.5A, dI/dt=100A/μs   |     | 17.2       | 21       | ns    |
| Q <sub>rr</sub>             | Body Diode Reverse Recovery Charge    | I <sub>F</sub> =8.5A, dI/dt=100A/μs   |     | 8.6        | 10       | nC    |

A: The value of R<sub>θJA</sub> is measured with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub>=25°C. The value in any given application depends on the user's specific board design. The current rating is based on the t ≤ 10s thermal resistance rating.

B: Repetitive rating, pulse width limited by junction temperature.

C: The R<sub>θJA</sub> is the sum of the thermal impedance from junction to lead R<sub>θJL</sub> and lead to ambient.

D: The static characteristics in Figures 1 to 6 are obtained using 80μs pulses, duty cycle 0.5% max.

E: These tests are performed with the device mounted on 1 in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub>=25°C. The SOA curve provides a single pulse rating.

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

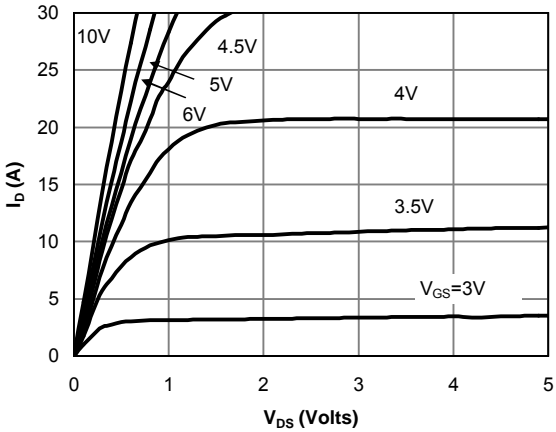


Fig 1: On-Region Characteristics

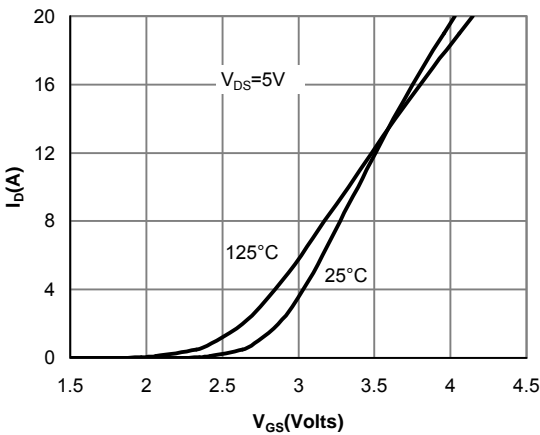


Figure 2: Transfer Characteristics

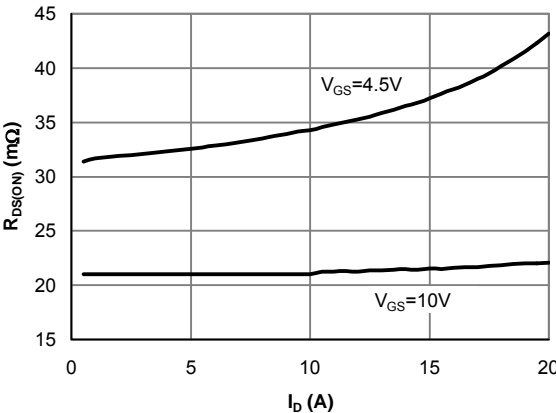


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

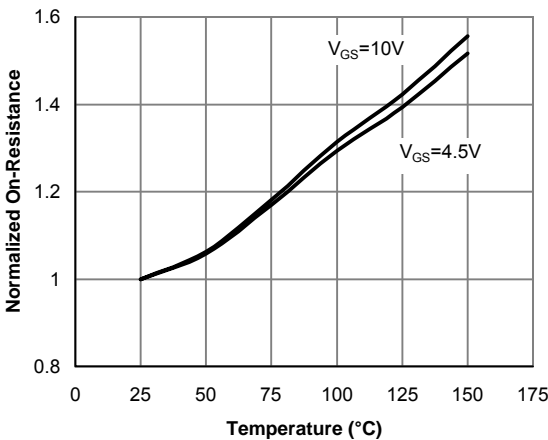


Figure 4: On-Resistance vs. Junction Temperature

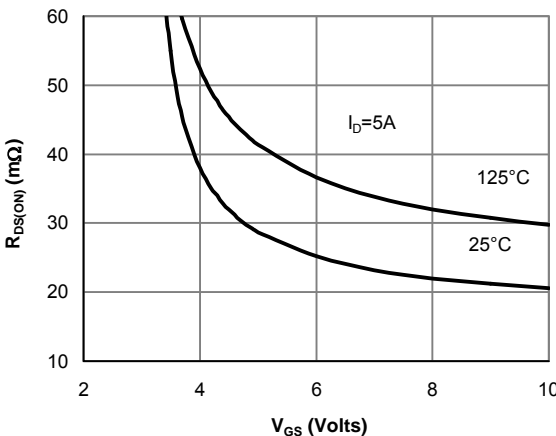


Figure 5: On-Resistance vs. Gate-Source Voltage

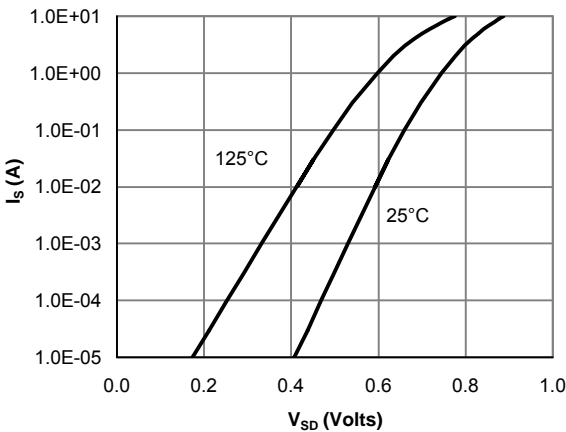


Figure 6: Body-Diode Characteristics

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

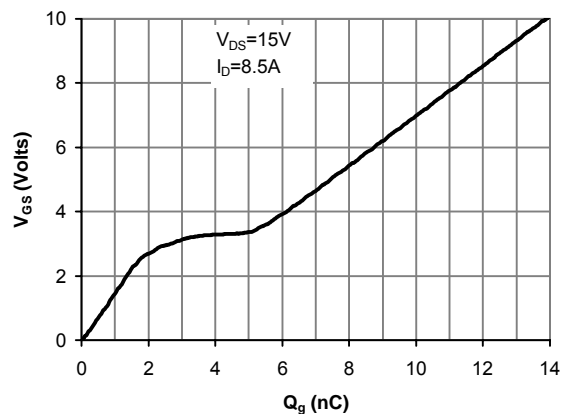


Figure 7: Gate-Charge Characteristics

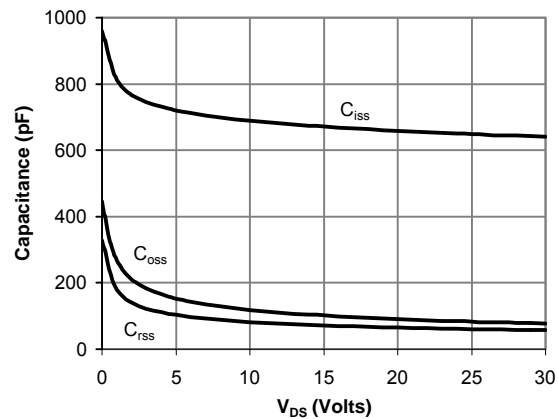


Figure 8: Capacitance Characteristics

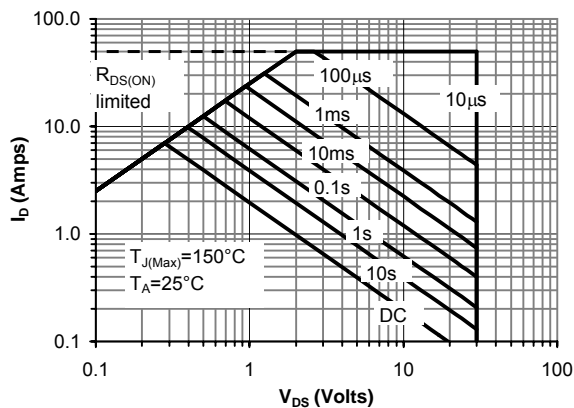


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

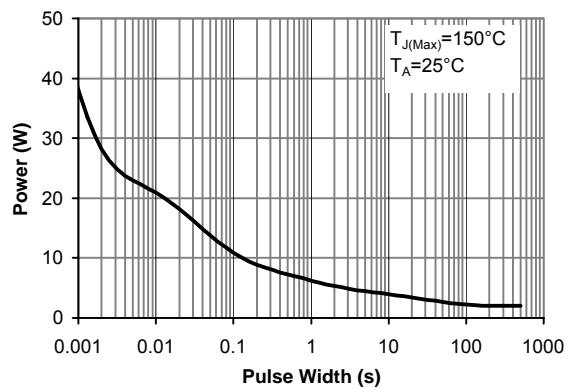


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

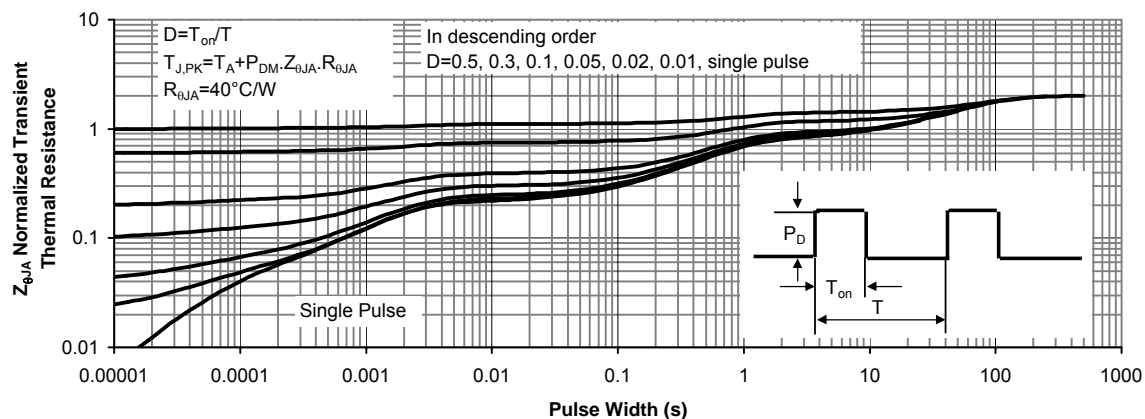


Figure 11: Normalized Maximum Transient Thermal Impedance