**ALPHA & OMEGA**
SEMICONDUCTOR, LTD

# AO6804

## Common-Drain Dual N-Channel Enhancement Mode Field Effect Transistor

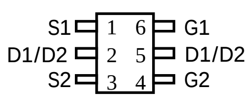
### General Description

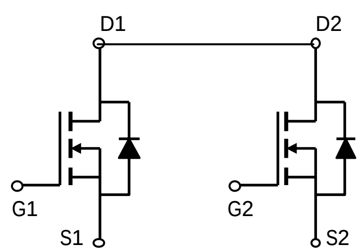
The AO6804 uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge and operation with gate voltages as low as 2.5V. This device is suitable for use as a load switch or in PWM applications. *AO6804 is Pb-free (meets ROHS & Sony 259 specifications).*

### Features

$V_{DS}$ = 20V
$I_D$ = 5.0A (V$_{GS}$ = 4.5V)
***Typical Rds***
$R_{DS(ON)}$ < 24mΩ ($V_{GS}$ = 4.5V)
$R_{DS(ON)}$ < 26mΩ ($V_{GS}$ = 4.0V)
$R_{DS(ON)}$ < 28mΩ ($V_{GS}$ = 3.1V)
$R_{DS(ON)}$ < 31mΩ ($V_{GS}$ = 2.5V)

**TSOP6**
**Top View**




| **Absolute Maximum Ratings $T_A$=25°C unless otherwise noted** | | | | | |
|---|---|---|---|---|---|
| **Parameter** | | **Symbol** | **10 Sec** | **Steady State** | **Units** |
| Drain-Source Voltage | | $V_{DS}$ | 20 | | V |
| Gate-Source Voltage | | $V_{GS}$ | ±12 | | V |
| Continuous Drain Current [A] | $T_A$=25°C | $I_D$ | 5 | 4 | A |
| | $T_A$=70°C | | 4 | 3.2 | |
| Pulsed Drain Current [B] | | $I_{DM}$ | 25 | | |
| Power Dissipation [A] | $T_A$=25°C | $P_D$ | 1.3 | 0.8 | W |
| | $T_A$=70°C | | 0.8 | 0.5 | |
| Junction and Storage Temperature Range | | $T_J$, $T_{STG}$ | -55 to 150 | | °C |

| **Thermal Characteristics** | | | | | |
|---|---|---|---|---|---|
| **Parameter** | | **Symbol** | **Typ** | **Max** | **Units** |
| Maximum Junction-to-Ambient [A] | t ≤ 10s | $R_{\theta JA}$ | 76 | 95 | °C/W |
| Maximum Junction-to-Ambient [A] | Steady State | | 118 | 150 | °C/W |
| Maximum Junction-to-Lead [C] | Steady State | $R_{\theta JL}$ | 54 | 68 | °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 | | 20 | | | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = 20V, $V_{GS}$ = 0V | | | | 1 | µA |
| | | | $T_J$ = 55°C | | | 5 | |
| $I_{GSS}$ | Gate-Body leakage current | $V_{DS}$ = 0V, $V_{GS}$ = ±12V | | | | ±500 | nA |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$ = $V_{GS}$ $I_D$ = 250µA | | 0.5 | 0.75 | 1.2 | V |
| $I_{D(ON)}$ | On state drain current | $V_{GS}$ = 4.5V, $V_{DS}$ = 5V | | 25 | | | A |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$ = 4.5V, $I_D$ = 5.0A | | 18 | 24 | 32 | mΩ |
| | | | $T_J$=125°C | 25 | 33 | 43 | |
| | | $V_{GS}$ = 4.0V, $I_D$ = 4.5A | | 22 | 26 | 34 | mΩ |
| | | $V_{GS}$ = 3.1V, $I_D$ = 4.5A | | 21 | 28 | 37 | mΩ |
| | | $V_{GS}$ = 2.5V, $I_D$ = 4.0A | | 22 | 31 | 42 | mΩ |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$ = 5V, $I_D$ = 5.0A | | | 7 | | S |
| $V_{SD}$ | Diode Forward Voltage | $I_S$ = 1A,$V_{GS}$ = 0V | | | 0.65 | 1 | V |
| $I_S$ | Maximum Body-Diode Continuous Current | | | | | 1.1 | A |
| **DYNAMIC PARAMETERS** | | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{GS}$=0V, $V_{DS}$=10V, f=1MHz | | | 580 | 725 | pF |
| $C_{oss}$ | Output Capacitance | | | | 95 | | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | | 70 | | pF |
| $R_g$ | Gate resistance | $V_{GS}$=0V, $V_{DS}$=0V, f=1MHz | | | 3.5 | 5.3 | Ω |
| **SWITCHING PARAMETERS** | | | | | | | |
| $Q_g$ | Total Gate Charge | $V_{GS}$= 4.5V, $V_{DS}$= 10V, $I_D$= 5A | | | 5.8 | 7.7 | nC |
| $Q_{gs}$ | Gate Source Charge | | | | 1 | | nC |
| $Q_{gd}$ | Gate Drain Charge | | | | 1.6 | | nC |
| $t_{D(on)}$ | Turn-On DelayTime | $V_{GS}$=10V, $V_{DS}$=10V, $R_L$=2.0Ω, $R_{GEN}$=3Ω | | | 2.4 | | ns |
| $t_r$ | Turn-On Rise Time | | | | 6.4 | | ns |
| $t_{D(off)}$ | Turn-Off DelayTime | | | | 38 | | ns |
| $t_f$ | Turn-Off Fall Time | | | | 9.5 | | ns |
| $t_{rr}$ | Body Diode Reverse Recovery Time | $I_F$=5A, dI/dt=100A/µs | | | 18 | 24 | ns |
| $Q_{rr}$ | Body Diode Reverse Recovery Charge | $I_F$=5A, dI/dt=100A/µs | | | 6 | | nC |

A: The value of $R_{\theta JA}$ is measured with the device mounted on 1in $^2$ FR-4 board with 2oz. Copper, in a still air environment with $T_A$ = 25°C. 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 $R_{\theta JA}$ is the sum of the thermal impedence from junction to lead $R_{\theta JL}$ and lead to ambient.
D. The static characteristics in Figures 1 to 6 are obtained using < 300 µs pulses, duty cycle 0.5% max.
E. These tests are performed with the device mounted on 1 in $^2$ FR-4 board with 2oz. Copper, in a still air environment with $T_A$=25°C. The SOA curve provides a single pulse rating.

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## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

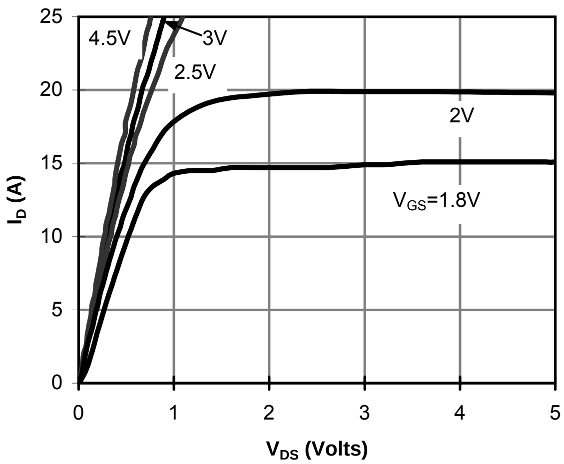


Figure 1: On-Region Characteristics

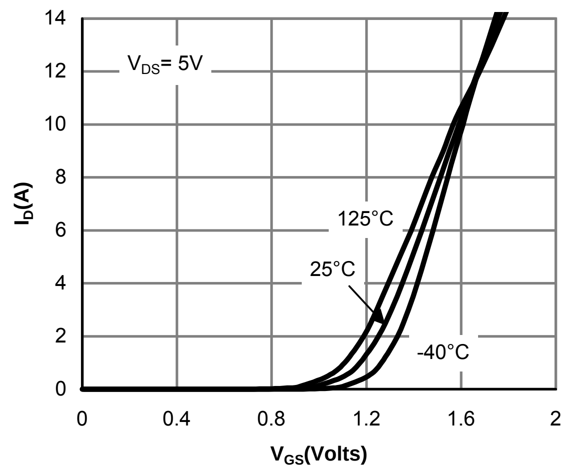


Figure 2: Transfer Characteristics

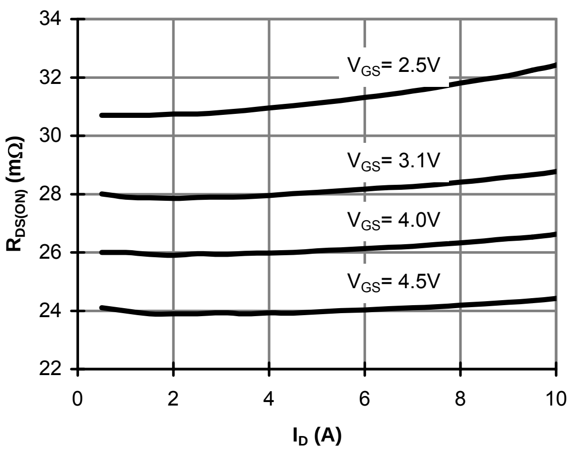


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

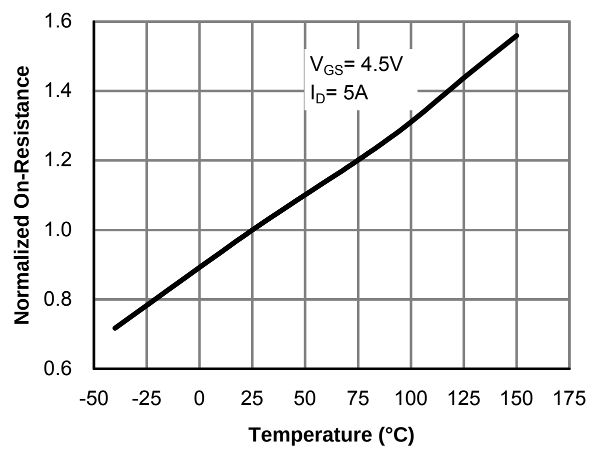


Figure 4: On-Resistance vs. Junction Temperature

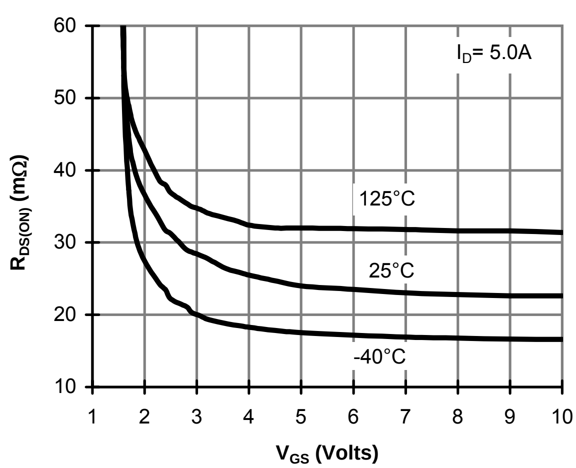


Figure 5: On-Resistance vs. Gate-Source Voltage

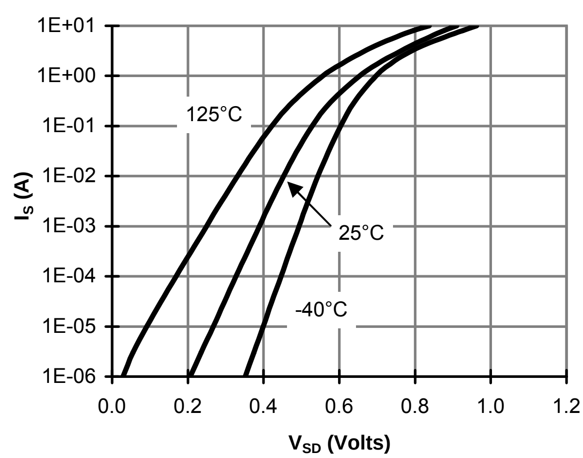


Figure 6: Body-Diode Characteristics

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

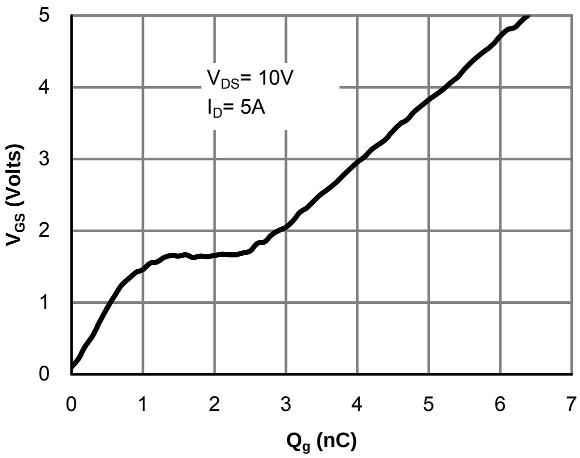


**Figure 7: Gate-Charge Characteristics**

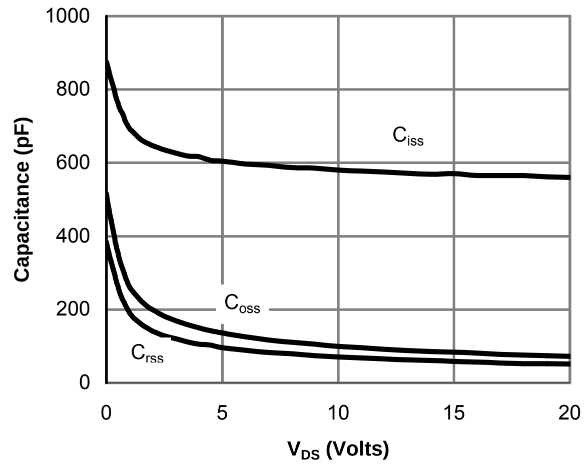


**Figure 8: Capacitance Characteristics**

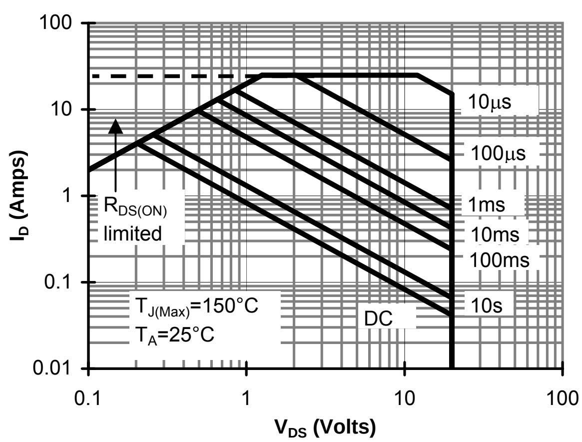


**Figure 9: Maximum Forward Biased Safe Operating Area (Note E)**

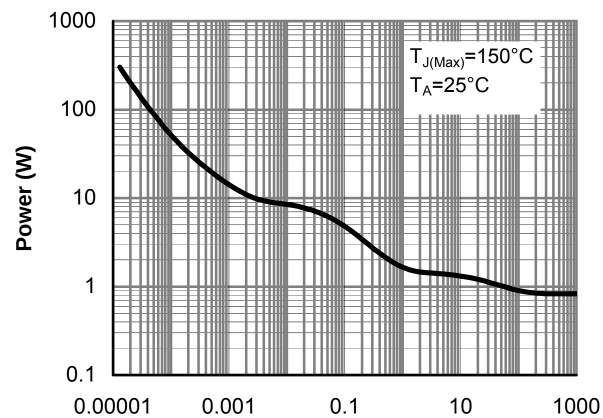


**Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)**

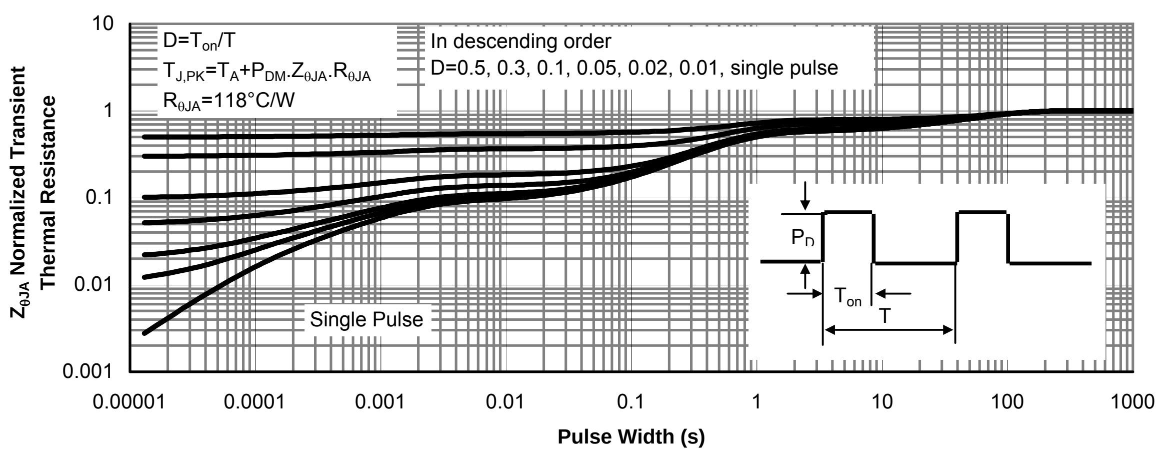


**Figure 11: Normalized Maximum Transient Thermal Impedance(Note E)**