



ALPHA & OMEGA
SEMICONDUCTOR

AOC3860A

12V Common-Drain Dual N-Channel MOSFET

General Description

- Trench Power MOSFET technology
- Low $R_{SS(ON)}$
- With ESD protection to improve battery performance and safety
- Common drain configuration for design simplicity
- RoHS and Halogen-Free Compliant

Applications

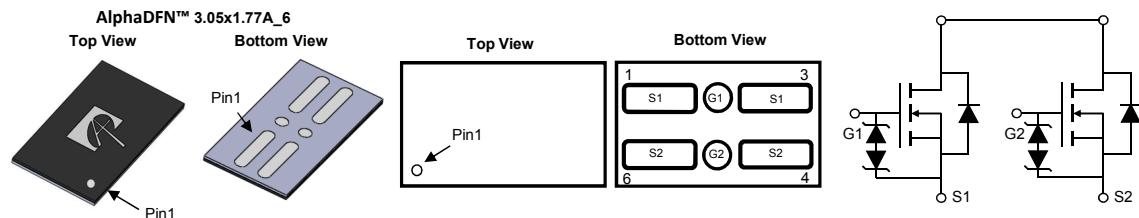
- Battery protection switch
- Mobile device battery charging and discharging

Product Summary

| | |
|----------------------------------|----------|
| V_{SS} | 12V |
| $R_{SS(ON)}$ (at $V_{GS}=4.5V$) | < 3.5mΩ |
| $R_{SS(ON)}$ (at $V_{GS}=4.0V$) | < 3.7mΩ |
| $R_{SS(ON)}$ (at $V_{GS}=3.8V$) | < 3.75mΩ |
| $R_{SS(ON)}$ (at $V_{GS}=3.1V$) | < 4.3mΩ |
| $R_{SS(ON)}$ (at $V_{GS}=2.5V$) | < 5mΩ |

Typical ESD protection

HBM Class 2



| Orderable Part Number | Package Type | Form | Minimum Order Quantity |
|-----------------------|-----------------------|-------------|------------------------|
| AOC3860A | AlphaDFN 3.05x1.77A_6 | Tape & Reel | 8000 |

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

| Parameter | Symbol | Rating | Units |
|--|--------------------------------|------------|-------|
| Source-Source Voltage | V_{SS} | 12 | V |
| Gate-Source Voltage | V_{GS} | ± 8 | V |
| Source Current(DC) ^{Note1} | I_S $T_A=25^\circ\text{C}$ | 25 | A |
| Source Current(Pulse) ^{Note2} | I_{SM} | 100 | |
| Power Dissipation ^{Note1} | P_D $T_A=25^\circ\text{C}$ | 2.5 | W |
| Junction and Storage Temperature Range | T_J, T_{STG} | -55 to 150 | °C |

Thermal Characteristics

| Parameter | Symbol | Typical | Units |
|-----------------------------|---------------------|-----------------|--------------------|
| Maximum Junction-to-Ambient | $t \leq 10\text{s}$ | $R_{\theta JA}$ | $^\circ\text{C/W}$ |
| Maximum Junction-to-Ambient | Steady-State | 50 | $^\circ\text{C/W}$ |

Note 1. I_S rated value is based on bare silicon. Mounted on 70mmx70mm FR-4 board.

Note 2. PW <10 μs pulses, duty cycle 1% max.

Electrical Characteristics ($T_J=25^\circ\text{C}$ unless otherwise noted)

| Symbol | Parameter | Conditions | Min | Typ | Max | Units | |
|-----------------------------|---------------------------------------|--|------------------------|-----|----------|------------------|------------------|
| STATIC PARAMETERS | | | | | | | |
| BV_{SSS} | Source-Source Breakdown Voltage | $I_S=250\mu\text{A}, V_{GS}=0\text{V}$ | Test Circuit 6 | 12 | | V | |
| I_{SSS} | Zero Gate Voltage Source Current | $V_{SS}=12\text{V}, V_{GS}=0\text{V}$ | Test Circuit 1 | | 1 | μA | |
| | | | $T_J=55^\circ\text{C}$ | | 5 | | |
| I_{GSS} | Gate leakage current | $V_{SS}=0\text{V}, V_{GS}=\pm 8\text{V}$ | Test Circuit 2 | | ± 10 | μA | |
| $V_{GS(\text{th})}$ | Gate Threshold Voltage | $V_{SS}=V_{GS}, I_S=250\mu\text{A}$ | Test Circuit 3 | 0.3 | 0.6 | 1.0 | V |
| $R_{SS(\text{ON})}$ | Static Source to Source On-Resistance | $V_{GS}=4.5\text{V}, I_S=5\text{A}$ | Test Circuit 4 | 2.0 | 2.8 | 3.5 | $\text{m}\Omega$ |
| | | $T_J=125^\circ\text{C}$ | | 2.7 | 3.85 | 4.8 | |
| | | $V_{GS}=4.0\text{V}, I_S=5\text{A}$ | Test Circuit 4 | 2.1 | 2.9 | 3.7 | $\text{m}\Omega$ |
| | | $V_{GS}=3.8\text{V}, I_S=5\text{A}$ | Test Circuit 4 | 2.2 | 2.95 | 3.75 | $\text{m}\Omega$ |
| | | $V_{GS}=3.1\text{V}, I_S=5\text{A}$ | Test Circuit 4 | 2.3 | 3.2 | 4.3 | $\text{m}\Omega$ |
| g_{FS} | Forward Transconductance | $V_{SS}=5\text{V}, I_S=5\text{A}$ | Test Circuit 4 | 2.5 | 3.6 | 5.0 | $\text{m}\Omega$ |
| | | | Test Circuit 3 | | 70 | | |
| V_{FSS} | Forward Source to Source Voltage | $I_S=1\text{A}, V_{GS}=0\text{V}$ | Test Circuit 5 | | 0.56 | 1 | V |
| DYNAMIC PARAMETERS | | | | | | | |
| R_g | Gate resistance | $f=1\text{MHz}$ | | | 1.2 | $\text{k}\Omega$ | |
| SWITCHING PARAMETERS | | | | | | | |
| Q_g | Total Gate Charge | $V_{G1S1}=4.5\text{V}, V_{SS}=6\text{V}, I_S=5\text{A}$ | | 44 | | nC | |
| $t_{D(\text{on})}$ | Turn-On DelayTime | $V_{G1S1}=4.5\text{V}, V_{SS}=6\text{V}, R_L=1.2\Omega,$ $R_{\text{GEN}}=3\Omega$ | Test Circuit 8 | 2 | | μs | |
| t_r | Turn-On Rise Time | | | 4.5 | | μs | |
| $t_{D(\text{off})}$ | Turn-Off DelayTime | | | 6 | | μs | |
| t_f | Turn-Off Fall Time | | | 11 | | μs | |

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

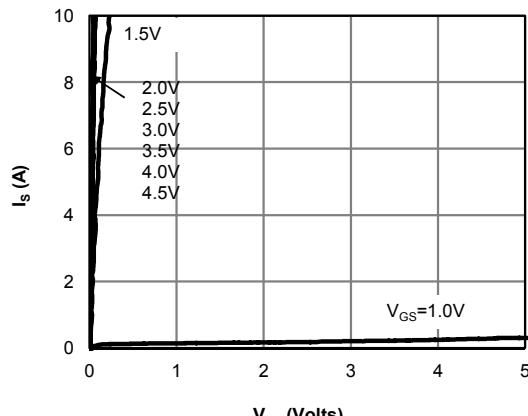


Figure 1: On-Region Characteristics

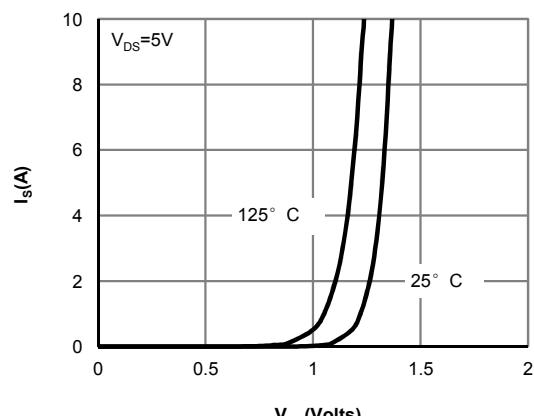


Figure 2: Transfer Characteristics

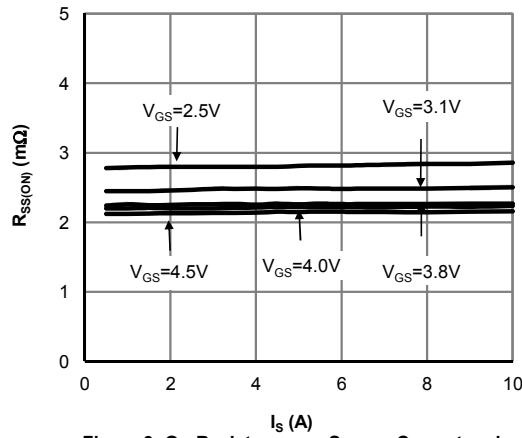


Figure 3: On-Resistance vs. Source Current and Gate Voltage

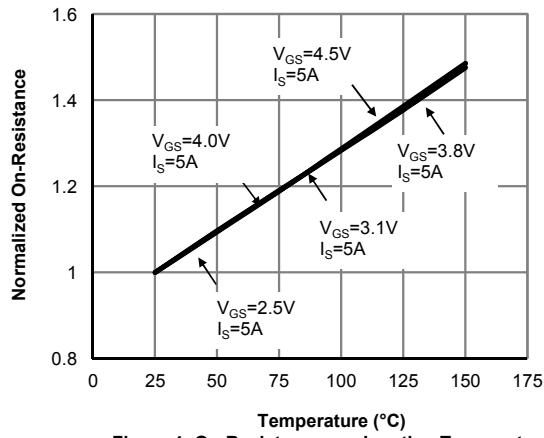


Figure 4: On-Resistance vs. Junction Temperature

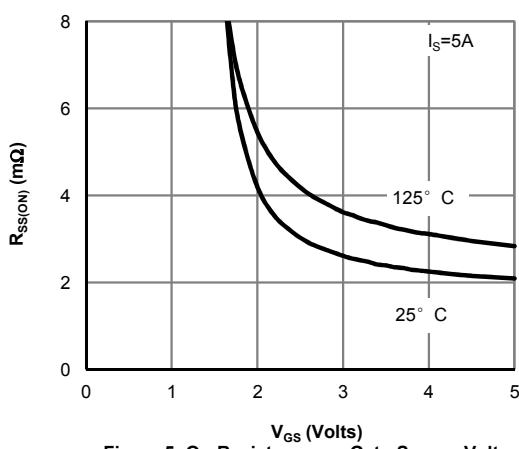


Figure 5: On-Resistance vs. Gate-Source Voltage

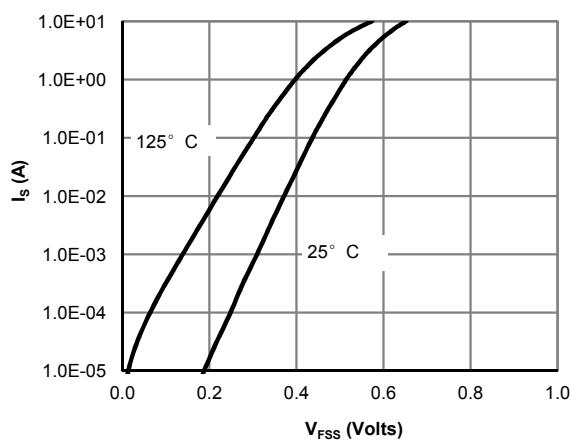


Figure 6: Forward Source to Source Characteristics



TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

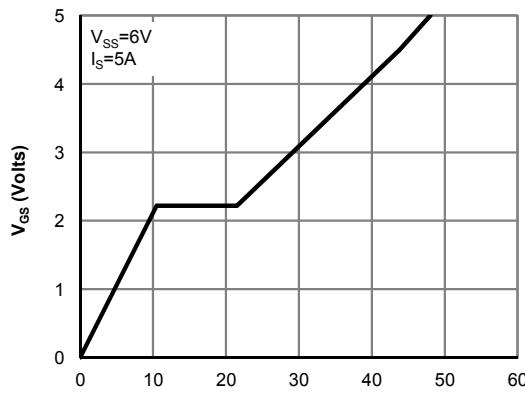


Figure 7: Gate-Charge Characteristics

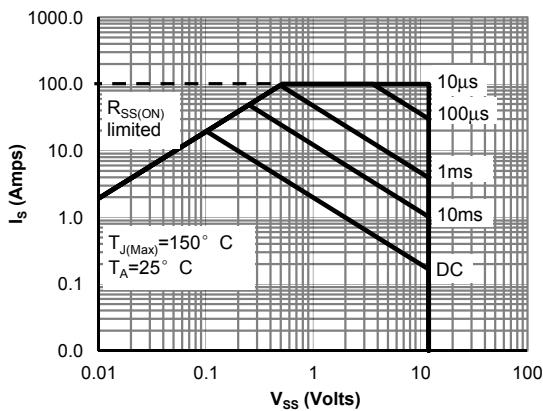


Figure 8: Maximum Forward Biased Safe Operating Area (Note1)

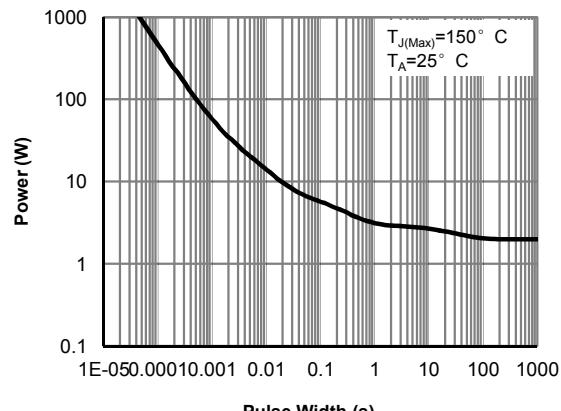


Figure 9: Single Pulse Power Rating Junction-to-Ambient (Note1)

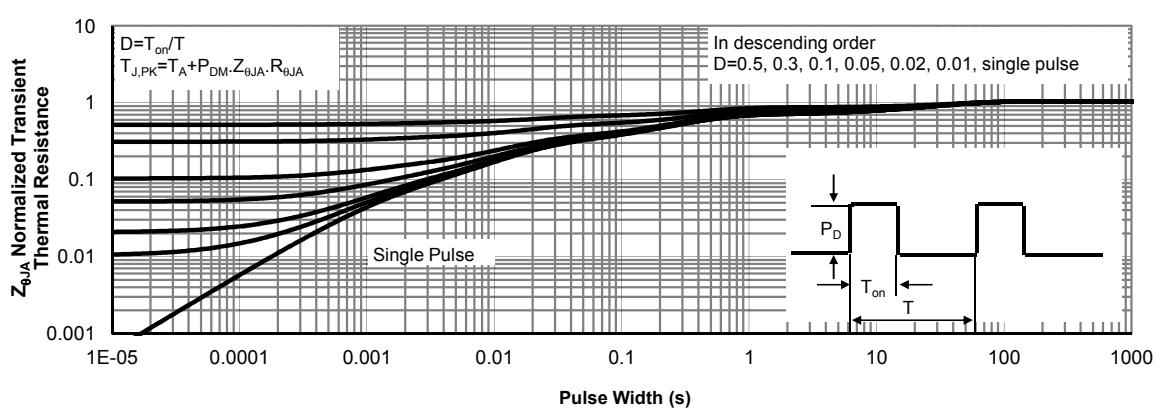
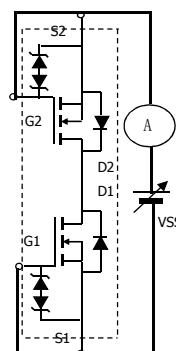


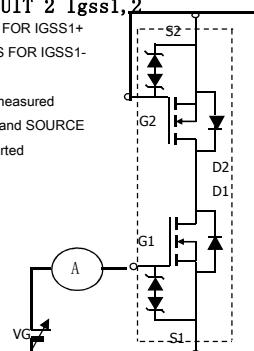
Figure 10: Normalized Maximum Transient Thermal Impedance (Note1)



TEST CIRCUIT 1 I_{SSS}
POSITIVE V_{SS} FOR I_{SSS+}
NEGATIVE V_{SS} FOR I_{SSS-}

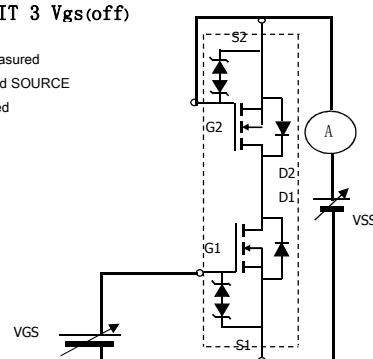


TEST CIRCUIT 2 $I_{GSS1,2}$
POSITIVE V_G FOR I_{GSS1+}
NEGATIVE V_G FOR I_{GSS1-}



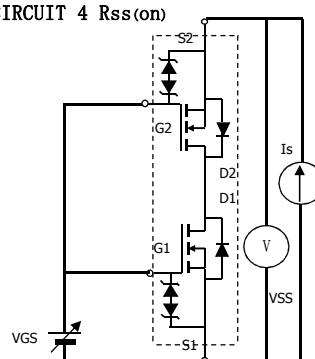
TEST CIRCUIT 3 $V_{GS(off)}$

When FET1 is measured
between GATE and SOURCE
of FET2 are shorted



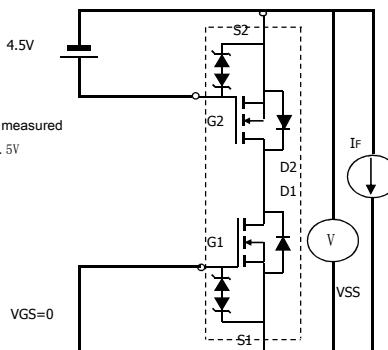
TEST CIRCUIT 4 $R_{SS(on)}$

V_{SS}/ I_S



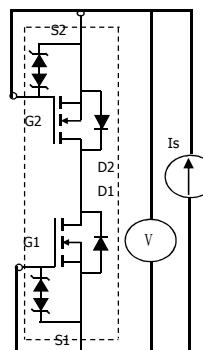
TEST CIRCUIT 5 $V_{F(ss),1,2}$

When FET1 measured
FET2 $V_{GS}=4.5V$



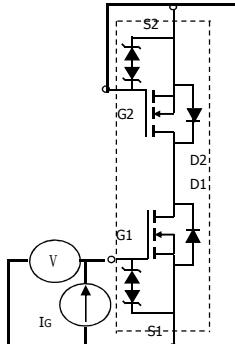
TEST CIRCUIT 6 BV_{DSS}

POSITIVE V_{SS} FOR I_{SSS+}
NEGATIVE V_{SS} FOR I_{SSS-}



TEST CIRCUIT 7 $BV_{GS01,2}$
POSITIVE V_{SS} FOR I_{SSS+}
NEGATIVE V_{SS} FOR I_{SSS-}

When FET1 is measured
between GATE and SOURCE
of FET2 are shorted



TEST CIRCUIT 8
Switching time

