

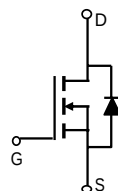
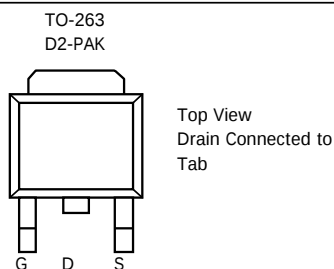
**AOB438**
**N-Channel Enhancement Mode Field Effect Transistor**

**General Description**

The AOB438 uses advanced trench technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. This device is suitable for use in PWM, load switching and general purpose applications. Standard product AOB438 is Pb-free (meets ROHS & Sony 259 specifications). AOB438L is a Green Product ordering option. AOB438 and AOB438L are electrically identical.

**Features**

$V_{DS}$  (V) = 25V  
 $I_D$  = 50A ( $V_{GS}$  = 10V)  
 $R_{DS(ON)}$  < 6.7 m $\Omega$  ( $V_{GS}$  = 10V)  
 $R_{DS(ON)}$  < 10 m $\Omega$  ( $V_{GS}$  = 4.5V)


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

| Parameter                                                 | Symbol                  | Maximum    | Units            |
|-----------------------------------------------------------|-------------------------|------------|------------------|
| Drain-Source Voltage                                      | $V_{DS}$                | 25         | V                |
| Gate-Source Voltage                                       | $V_{GS}$                | $\pm 20$   | V                |
| Continuous Drain Current <sup>G</sup>                     | $I_D$                   | 50         | A                |
|                                                           | $T_C=100^\circ\text{C}$ | 50         |                  |
| Pulsed Drain Current <sup>C</sup>                         | $I_{DM}$                | 150        |                  |
| Avalanche Current <sup>C</sup>                            | $I_{AR}$                | 30         | A                |
| Repetitive avalanche energy $L=0.3\text{mH}$ <sup>C</sup> | $E_{AR}$                | 135        | mJ               |
| Power Dissipation <sup>B</sup>                            | $P_D$                   | 50         | W                |
|                                                           | $T_C=100^\circ\text{C}$ | 25         |                  |
| Power Dissipation <sup>A</sup>                            | $P_{DSM}$               | 3          | W                |
|                                                           | $T_A=70^\circ\text{C}$  | 2.1        |                  |
| 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 <sup>A</sup> | $R_{\theta JA}$ | 15  | 20  | $^\circ\text{C/W}$ |
| Maximum Junction-to-Ambient <sup>A</sup> |                 | 41  | 50  | $^\circ\text{C/W}$ |
| Maximum Junction-to-Case <sup>B</sup>    | $R_{\theta JC}$ | 2.1 | 3   | $^\circ\text{C/W}$ |

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

| Symbol                      | Parameter                             | Conditions                                                                           | Min | Typ  | Max    | Units         |
|-----------------------------|---------------------------------------|--------------------------------------------------------------------------------------|-----|------|--------|---------------|
| <b>STATIC PARAMETERS</b>    |                                       |                                                                                      |     |      |        |               |
| $BV_{DSS}$                  | Drain-Source Breakdown Voltage        | $I_D=250\mu\text{A}$ , $V_{GS}=0\text{V}$                                            | 25  |      |        | V             |
| $I_{DSS}$                   | Zero Gate Voltage Drain Current       | $V_{DS}=20\text{V}$ , $V_{GS}=0\text{V}$<br>$T_J=55^\circ\text{C}$                   |     |      | 1<br>5 | $\mu\text{A}$ |
| $I_{GSS}$                   | Gate-Body leakage current             | $V_{DS}=0\text{V}$ , $V_{GS}=\pm 20\text{V}$                                         |     |      | 100    | nA            |
| $V_{GS(th)}$                | Gate Threshold Voltage                | $V_{DS}=V_{GS}$ , $I_D=250\mu\text{A}$                                               | 1   | 1.2  | 2.5    | V             |
| $I_{D(ON)}$                 | On state drain current                | $V_{GS}=10\text{V}$ , $V_{DS}=5\text{V}$                                             | 150 |      |        | A             |
| $R_{DS(ON)}$                | Static Drain-Source On-Resistance     | $V_{GS}=10\text{V}$ , $I_D=30\text{A}$                                               |     | 5    | 6.7    | m $\Omega$    |
|                             |                                       | $T_J=125^\circ\text{C}$                                                              |     | 7.5  |        |               |
|                             |                                       | $V_{GS}=4.5\text{V}$ , $I_D=30\text{A}$                                              |     | 7.6  | 10     |               |
| $g_{FS}$                    | Forward Transconductance              | $V_{DS}=5\text{V}$ , $I_D=30\text{A}$                                                |     | 49   |        | S             |
| $V_{SD}$                    | Diode Forward Voltage                 | $I_S=1\text{A}$ , $V_{GS}=0\text{V}$                                                 |     | 0.74 | 1      | V             |
| $I_S$                       | Maximum Body-Diode Continuous Current |                                                                                      |     |      | 50     | A             |
| <b>DYNAMIC PARAMETERS</b>   |                                       |                                                                                      |     |      |        |               |
| $C_{iss}$                   | Input Capacitance                     | $V_{GS}=0\text{V}$ , $V_{DS}=12.5\text{V}$ , $f=1\text{MHz}$                         |     | 2050 | 2500   | pF            |
| $C_{oss}$                   | Output Capacitance                    |                                                                                      |     | 485  |        | pF            |
| $C_{rss}$                   | Reverse Transfer Capacitance          |                                                                                      |     | 280  |        | pF            |
| $R_g$                       | Gate resistance                       | $V_{GS}=0\text{V}$ , $V_{DS}=0\text{V}$ , $f=1\text{MHz}$                            |     | 0.86 | 1.5    | $\Omega$      |
| <b>SWITCHING PARAMETERS</b> |                                       |                                                                                      |     |      |        |               |
| $Q_g(10\text{V})$           | Total Gate Charge                     | $V_{GS}=10\text{V}$ , $V_{DS}=12.5\text{V}$ , $I_D=30\text{A}$                       |     | 34   | 41     | nC            |
| $Q_g(4.5\text{V})$          | Total Gate Charge                     |                                                                                      |     | 17   | 22     | nC            |
| $Q_{gs}$                    | Gate Source Charge                    |                                                                                      |     | 5    |        | nC            |
| $Q_{gd}$                    | Gate Drain Charge                     |                                                                                      |     | 3.5  |        | nC            |
| $t_{D(on)}$                 | Turn-On DelayTime                     | $V_{GS}=10\text{V}$ , $V_{DS}=12.5\text{V}$ , $R_L=0.4\Omega$ ,<br>$R_{GEN}=3\Omega$ |     | 7.5  |        | ns            |
| $t_r$                       | Turn-On Rise Time                     |                                                                                      |     | 11   |        | ns            |
| $t_{D(off)}$                | Turn-Off DelayTime                    |                                                                                      |     | 27   |        | ns            |
| $t_f$                       | Turn-Off Fall Time                    |                                                                                      |     | 8    |        | ns            |
| $t_{rr}$                    | Body Diode Reverse Recovery Time      | $I_F=30\text{A}$ , $dI/dt=100\text{A}/\mu\text{s}$                                   |     | 30   | 36     | ns            |
| $Q_{rr}$                    | Body Diode Reverse Recovery Charge    | $I_F=30\text{A}$ , $dI/dt=100\text{A}/\mu\text{s}$                                   |     | 19   |        | nC            |

A: The value of  $R_{\theta JA}$  is measured with the device mounted on 1 in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with  $T_A=25^\circ\text{C}$ . The Power dissipation  $P_{DSM}$  is based on  $R_{\theta JA}$  and the maximum allowed junction temperature of  $150^\circ\text{C}$ . The value in any given application depends on the user's specific board design, and the maximum temperature of  $175^\circ\text{C}$  may be used if the PCB allows it.

B: The power dissipation  $P_D$  is based on  $T_{J(MAX)}=175^\circ\text{C}$ , 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  $T_{J(MAX)}=175^\circ\text{C}$ .

D: The  $R_{\theta JA}$  is the sum of the thermal impedance from junction to case  $R_{\theta JC}$  and case to ambient.

E: The static characteristics in Figures 1 to 6 are obtained using  $<300 \mu\text{s}$  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  $T_{J(MAX)}=175^\circ\text{C}$ .

G: The maximum current rating is limited by bond-wires.

H: 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  $T_A=25^\circ\text{C}$ . The SOA curve provides a single pulse rating.

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

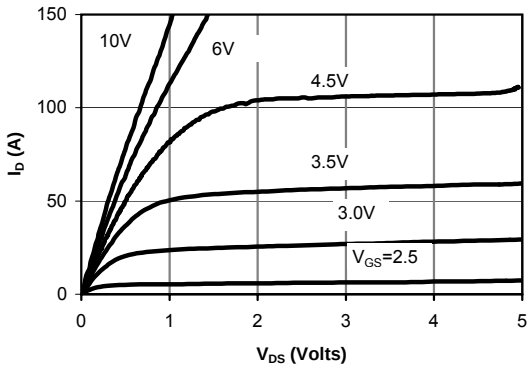


Fig 1: On-Region Characteristics

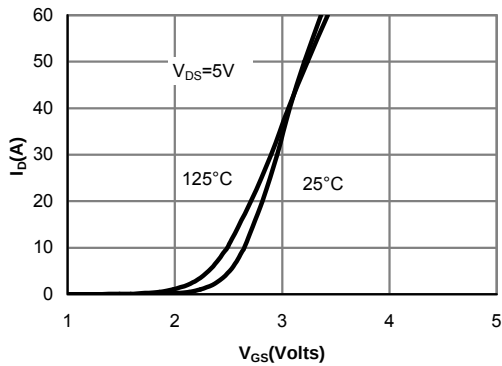


Figure 2: Transfer Characteristics

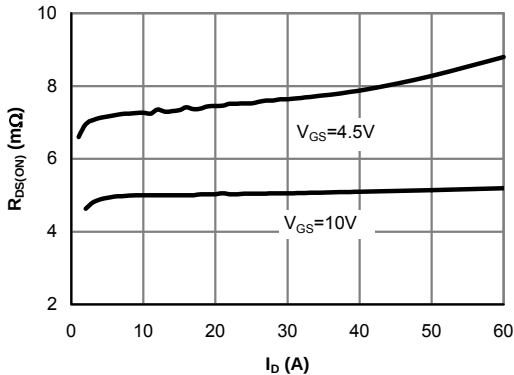


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

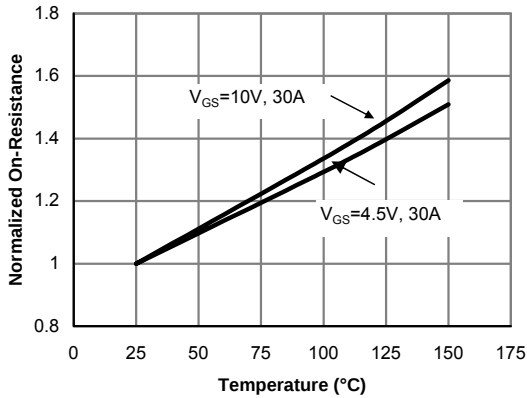


Figure 4: On-Resistance vs. Junction Temperature

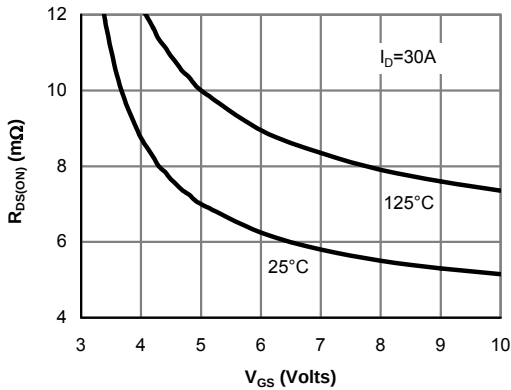


Figure 5: On-Resistance vs. Gate-Source Voltage

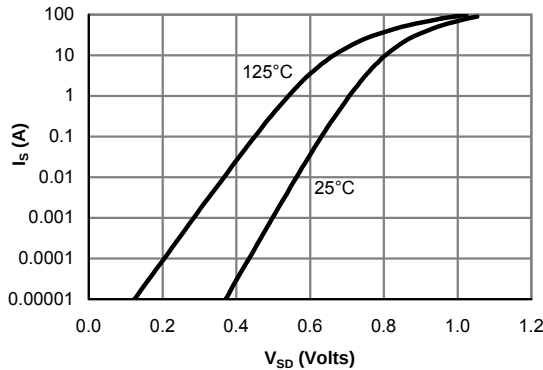


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

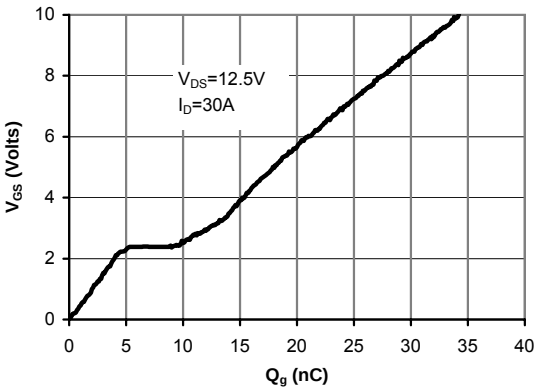


Figure 7: Gate-Charge Characteristics

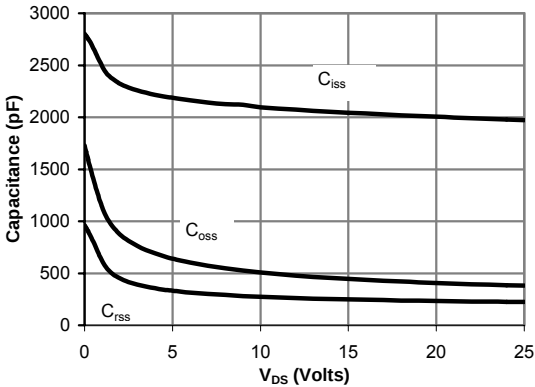


Figure 8: Capacitance Characteristics

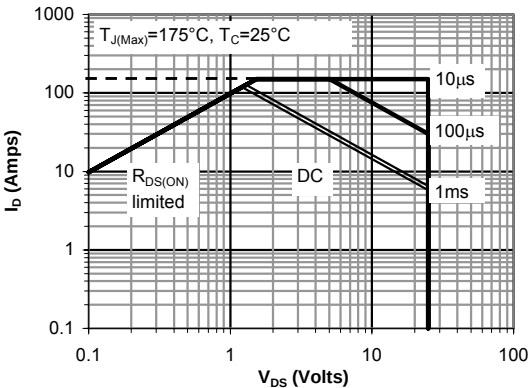


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

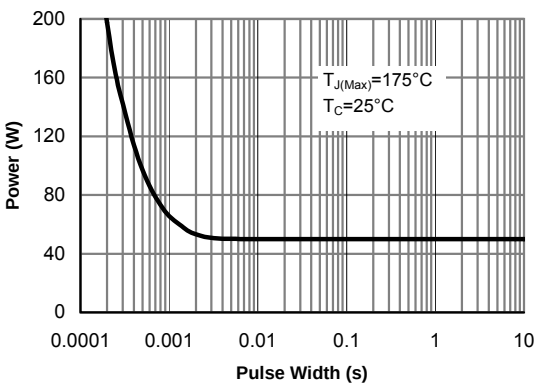


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

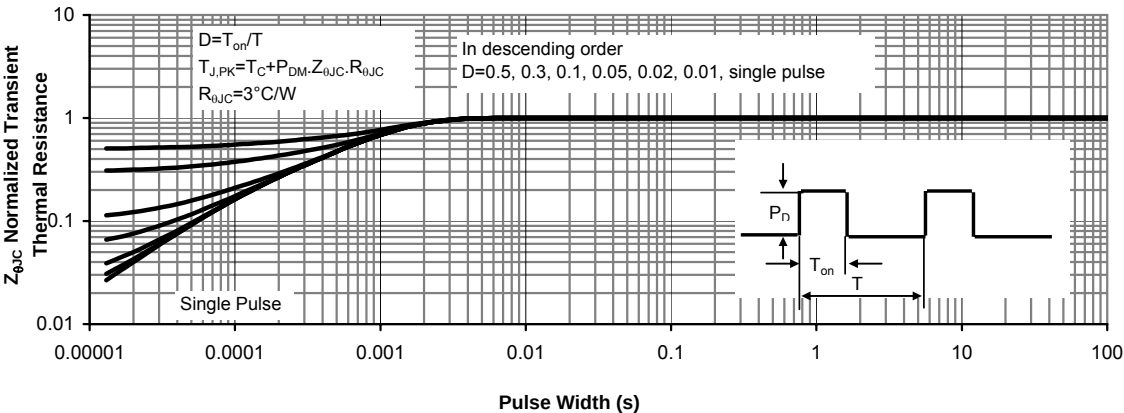


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

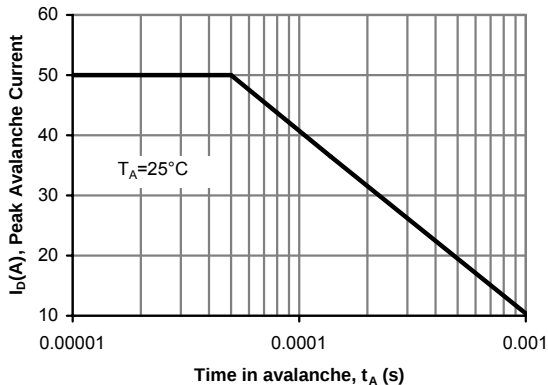


Figure 12: Single Pulse Avalanche capability

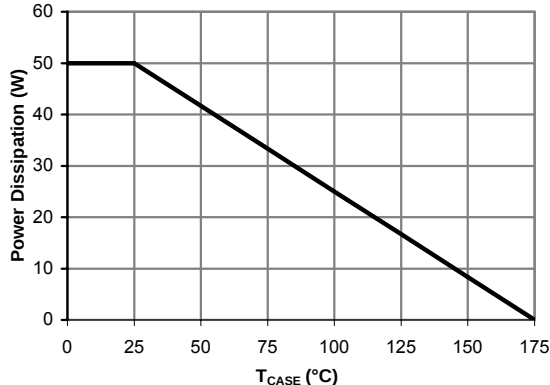


Figure 13: Power De-rating (Note B)

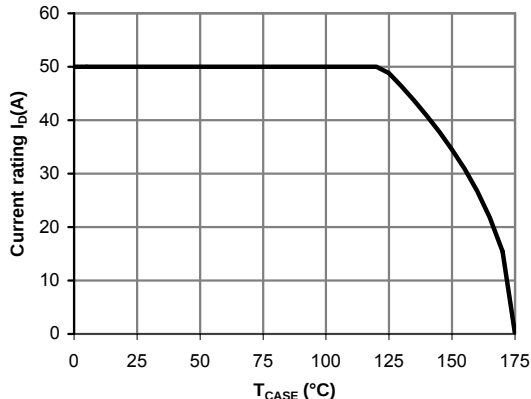


Figure 14: Current De-rating (Note B)

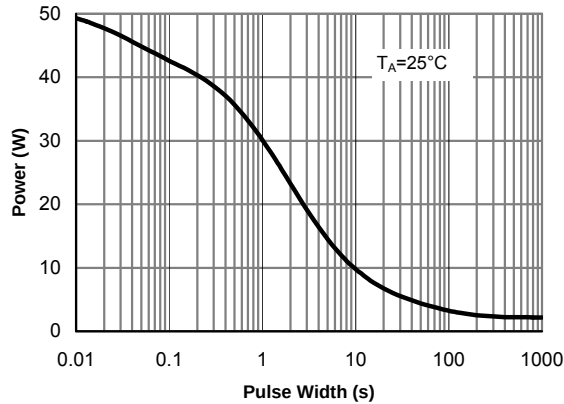


Figure 15: Single Pulse Power Rating Junction-to-Ambient (Note H)

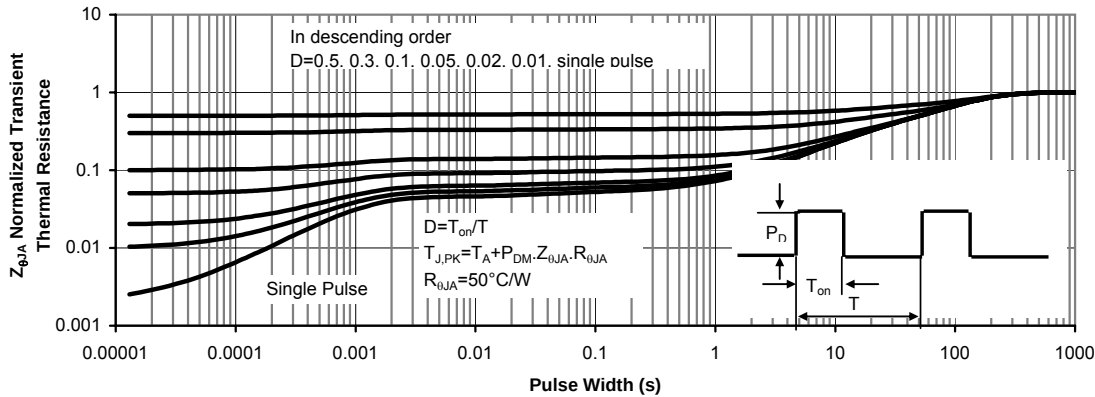


Figure 16: Normalized Maximum Transient Thermal Impedance (Note H)