



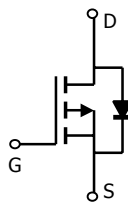
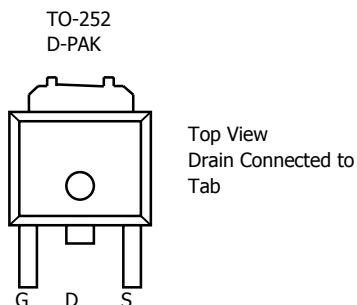
## AOD405, AOD405L (Green Product) P-Channel Enhancement Mode Field Effect Transistor

### General Description

The AOD405 uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and low gate resistance. With the excellent thermal resistance of the DPAK package, this device is well suited for high current load applications. AOD405L (Green Product) is offered in a lead-free package.

### Features

$V_{DS}$  (V) = -30V  
 $I_D$  = -18A  
 $R_{DS(ON)} < 32m\Omega$  ( $V_{GS} = -10V$ )  
 $R_{DS(ON)} < 60m\Omega$  ( $V_{GS} = -4.5V$ )



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

| Parameter                                                 | Symbol         | Maximum                              | Units            |
|-----------------------------------------------------------|----------------|--------------------------------------|------------------|
| Drain-Source Voltage                                      | $V_{DS}$       | -30                                  | V                |
| Gate-Source Voltage                                       | $V_{GS}$       | $\pm 20$                             | V                |
| Continuous Drain Current <sup>B,G</sup>                   | $I_D$          | $T_A=25^\circ\text{C}$ <sup>G</sup>  | A                |
|                                                           |                | $T_A=100^\circ\text{C}$ <sup>G</sup> |                  |
| Pulsed Drain Current                                      | $I_{DM}$       | -40                                  |                  |
| Avalanche Current <sup>C</sup>                            | $I_{AR}$       | -18                                  | A                |
| Repetitive avalanche energy $L=0.1\text{mH}$ <sup>C</sup> | $E_{AR}$       | 40                                   | mJ               |
| Power Dissipation <sup>B</sup>                            | $P_D$          | $T_C=25^\circ\text{C}$               | W                |
|                                                           |                | $T_C=100^\circ\text{C}$              |                  |
| Power Dissipation <sup>A</sup>                            | $P_{DSM}$      | $T_A=25^\circ\text{C}$               | W                |
|                                                           |                | $T_A=70^\circ\text{C}$               |                  |
| 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> | $t \leq 10\text{s}$ | $R_{\theta JA}$ | 16.7 | 25  | $^\circ\text{C/W}$ |
| Maximum Junction-to-Ambient <sup>A</sup> | Steady-State        |                 | 40   | 50  | $^\circ\text{C/W}$ |
| Maximum Junction-to-Case <sup>C</sup>    | Steady-State        | $R_{\theta JL}$ | 1.9  | 2.5 | $^\circ\text{C/W}$ |

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        | $I_D=-250\mu\text{A}$ , $V_{GS}=0\text{V}$                                            | -30  |        |           | V                |
| $I_{DSS}$                   | Zero Gate Voltage Drain Current       | $V_{DS}=-24\text{V}$ , $V_{GS}=0\text{V}$<br>$T_J=55^\circ\text{C}$                   |      | -0.003 | -1        | $\mu\text{A}$    |
| $I_{GSS}$                   | Gate-Body leakage current             | $V_{DS}=0\text{V}$ , $V_{GS}=\pm 20\text{V}$                                          |      |        | $\pm 100$ | nA               |
| $V_{GS(th)}$                | Gate Threshold Voltage                | $V_{DS}=V_{GS}$ , $I_D=-250\mu\text{A}$                                               | -1.2 | -2     | -2.4      | V                |
| $I_{D(ON)}$                 | On state drain current                | $V_{GS}=-10\text{V}$ , $V_{DS}=-5\text{V}$                                            | -40  |        |           | A                |
| $R_{DS(ON)}$                | Static Drain-Source On-Resistance     | $V_{GS}=-10\text{V}$ , $I_D=-18\text{A}$<br>$T_J=125^\circ\text{C}$                   |      | 24.5   | 32        | $\text{m}\Omega$ |
|                             |                                       | $V_{GS}=-4.5\text{V}$ , $I_D=-10\text{A}$                                             |      | 36     | 43        | $\text{m}\Omega$ |
|                             |                                       |                                                                                       |      | 41     | 60        | $\text{m}\Omega$ |
| $g_{FS}$                    | Forward Transconductance              | $V_{DS}=-5\text{V}$ , $I_D=-18\text{A}$                                               |      | 17     |           | S                |
| $V_{SD}$                    | Diode Forward Voltage                 | $I_S=-1\text{A}$ , $V_{GS}=0\text{V}$                                                 |      | -0.76  | -1        | V                |
| $I_S$                       | Maximum Body-Diode Continuous Current |                                                                                       |      |        | -18       | A                |
| <b>DYNAMIC PARAMETERS</b>   |                                       |                                                                                       |      |        |           |                  |
| $C_{iss}$                   | Input Capacitance                     | $V_{GS}=0\text{V}$ , $V_{DS}=-15\text{V}$ , $f=1\text{MHz}$                           |      | 920    | 1100      | pF               |
| $C_{oss}$                   | Output Capacitance                    |                                                                                       |      | 190    |           | pF               |
| $C_{rss}$                   | Reverse Transfer Capacitance          |                                                                                       |      | 122    |           | pF               |
| $R_g$                       | Gate resistance                       | $V_{GS}=0\text{V}$ , $V_{DS}=0\text{V}$ , $f=1\text{MHz}$                             |      | 3.6    | 4.5       | $\Omega$         |
| <b>SWITCHING PARAMETERS</b> |                                       |                                                                                       |      |        |           |                  |
| $Q_g(10\text{V})$           | Total Gate Charge (10V)               | $V_{GS}=-10\text{V}$ , $V_{DS}=-15\text{V}$ , $I_D=-18\text{A}$                       |      | 18.7   | 23        | nC               |
| $Q_g(4.5\text{V})$          | Total Gate Charge (4.5V)              |                                                                                       |      | 9.7    | 11.7      | nC               |
| $Q_{gs}$                    | Gate Source Charge                    |                                                                                       |      | 2.54   |           | nC               |
| $Q_{gd}$                    | Gate Drain Charge                     |                                                                                       |      | 5.4    |           | nC               |
| $t_{D(on)}$                 | Turn-On DelayTime                     | $V_{GS}=-10\text{V}$ , $V_{DS}=-15\text{V}$ , $R_L=0.82\Omega$ ,<br>$R_{GEN}=3\Omega$ |      | 9      | 13        | ns               |
| $t_r$                       | Turn-On Rise Time                     |                                                                                       |      | 25     | 35        | ns               |
| $t_{D(off)}$                | Turn-Off DelayTime                    |                                                                                       |      | 20     | 30        | ns               |
| $t_f$                       | Turn-Off Fall Time                    |                                                                                       |      | 12     | 18        | ns               |
| $t_{rr}$                    | Body Diode Reverse Recovery Time      | $I_F=-18\text{A}$ , $dI/dt=100\text{A}/\mu\text{s}$                                   |      | 21.4   | 26        | ns               |
| $Q_{rr}$                    | Body Diode Reverse Recovery Charge    | $I_F=-18\text{A}$ , $dI/dt=100\text{A}/\mu\text{s}$                                   |      | 13     | 16        | nC               |

A: The value of  $R_{\theta JA}$  is measured with the device mounted on 1in<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 steady-state  $R_{\theta JA}$  and the maximum allowed junction temperature of  $150^\circ\text{C}$ . The value in any a given application depends on the user's specific board design, and the maximum temperature fo  $175^\circ\text{C}$  may be used if the PCB or heatsink 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. It is used to determine the current rating, when this rating falls below the package limit.

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 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.

G: The maximum current rating is limited by the package current capability.

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

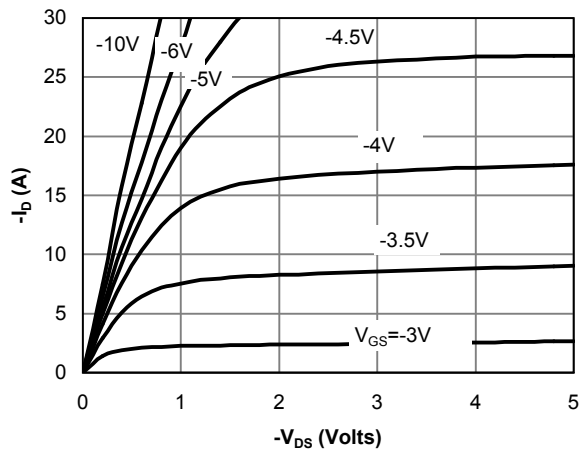


Fig 1: On-Region Characteristics

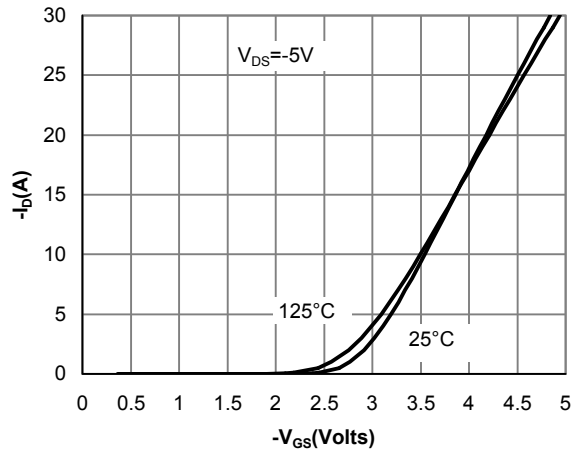


Figure 2: Transfer Characteristics

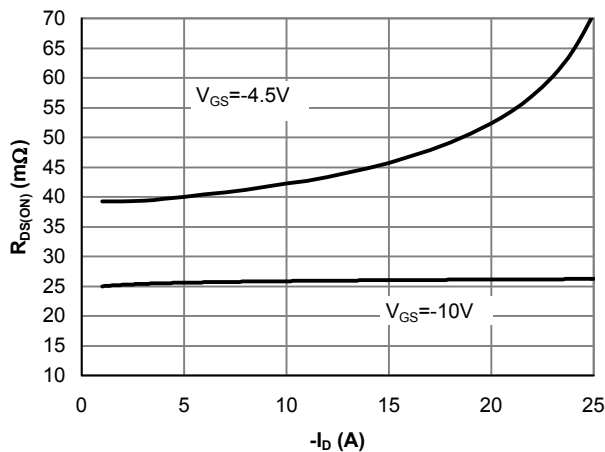


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

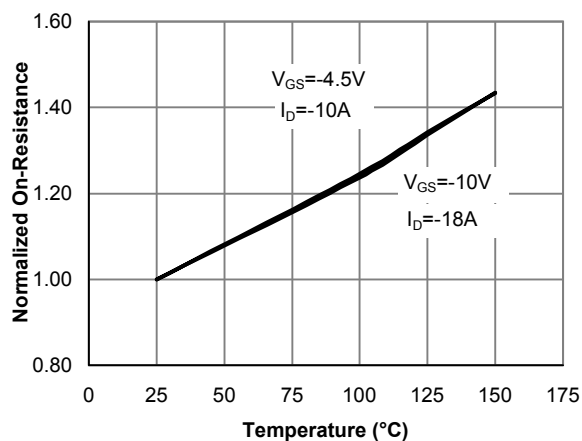


Figure 4: On-Resistance vs. Junction Temperature

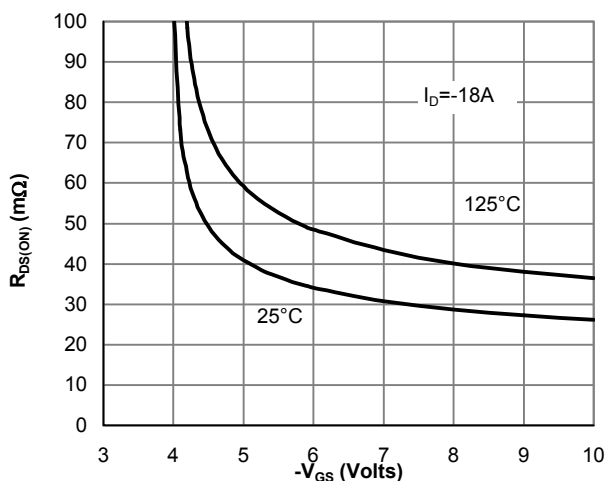


Figure 5: On-Resistance vs. Gate-Source Voltage

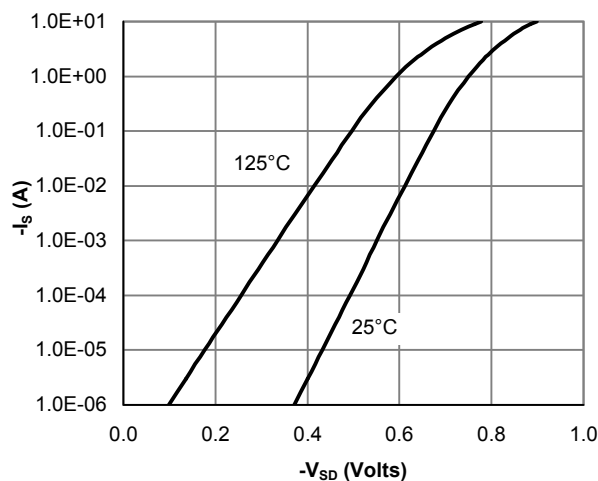


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

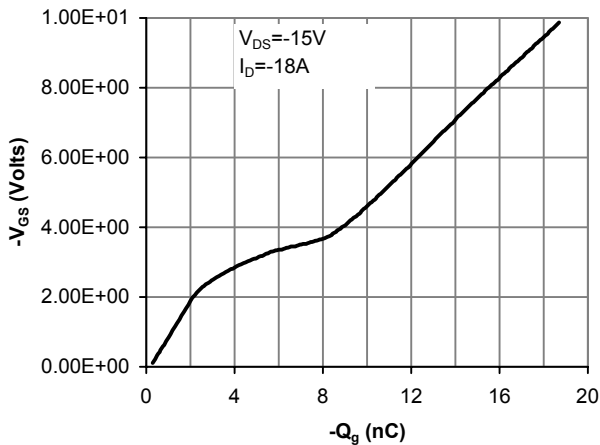


Figure 7: Gate-Charge Characteristics

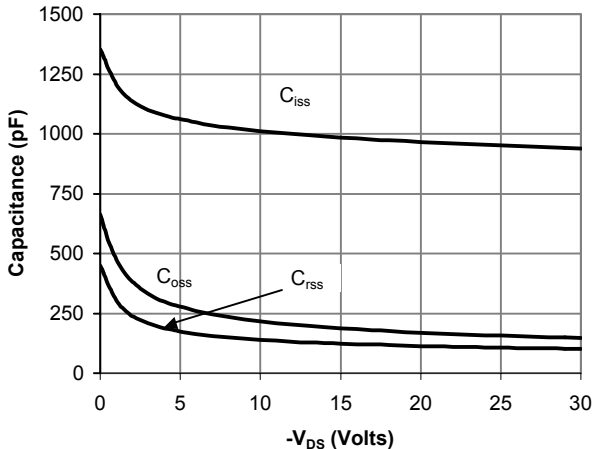


Figure 8: Capacitance Characteristics

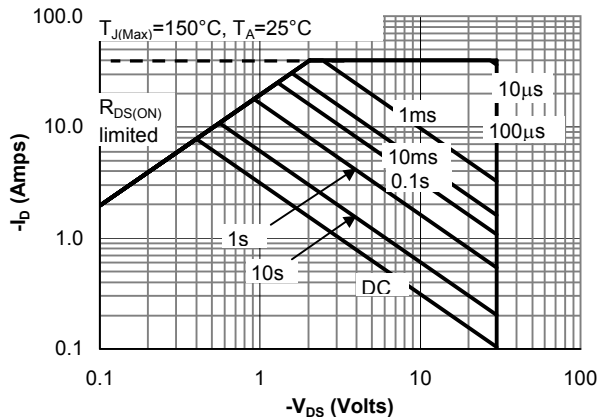


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

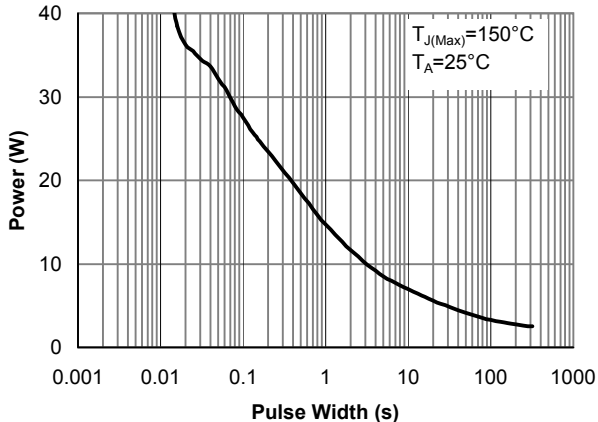


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note F)

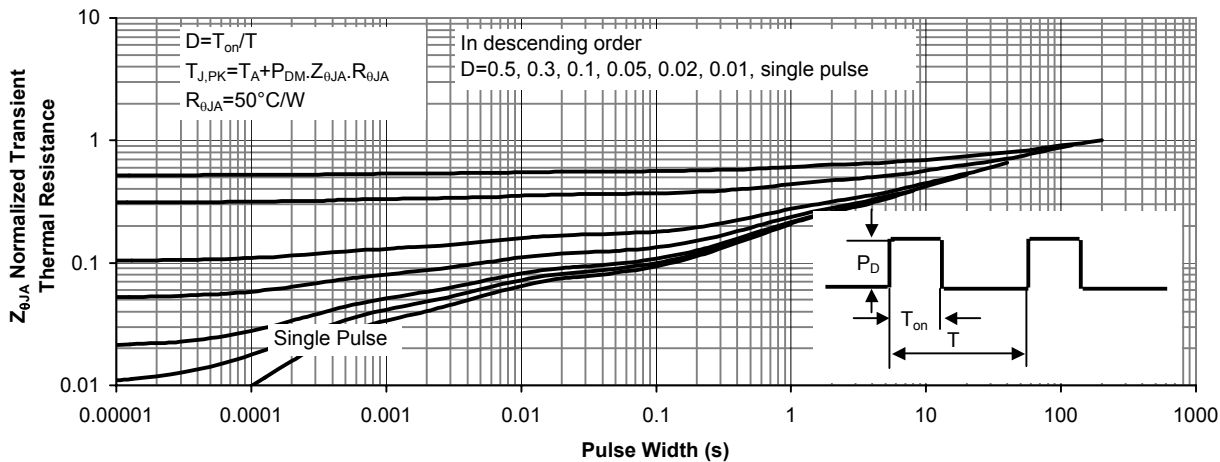


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)