

1.Description

The AOD413A uses advanced technology and design to provide excellent $R_{DS(ON)}$ with low gate charge. With the excellent thermal resistance of the DPAK package, this device is well suited for high current load applications.

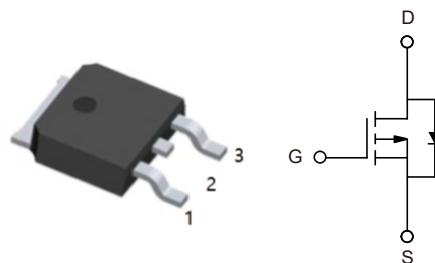
2.Features

- $V_{DS(V)} = -40V$
- $I_D = -12A (V_{GS} = 10V)$
- $R_{DS(ON)} < 40m\Omega (V_{GS} = -10V)$
- $R_{DS(ON)} < 50m\Omega (V_{GS} = -4.5V)$

3.Pinning information

Pin	Symbol	Description
1	G	GATE
3	S	SOURCE
2	D	DRAIN

TO-252(DPAK)
top view



4.Absolute Maximum Ratings $T_A = 25^\circ C$

Parameter		Symbol	Rating	Units
Drain-Source Voltage		V_{DS}	-40	V
Gate-Source Voltage		V_{GS}	± 20	
Continuous Drain Current ^{B,H}	$T_C = 25^\circ C$	I_D	-12	A
	$T_C = 100^\circ C$		-12	
Pulsed Drain Current ^c		I_{DM}	-30	
Avalanche Current ^c		I_{AR}	-20	
Repetitive avalanche energy $L=0.1mH$ ^c		E_{AR}	20	mJ
Power Dissipation ^B	$T_C = 25^\circ C$	P_D	50	W
	$T_C = 100^\circ C$		25	
Power Dissipation ^A	$T_A = 25^\circ C$	P_{DSM}	2.5	
	$T_A = 70^\circ C$		1.6	
Junction and Storage Temperature Range		T_J, T_{STG}	-55 to 150	$^\circ C$



5.Thermal Characteristics

Parameter		Symbol	Typ	Max	Units
Maximum Junction-to-Ambient ^A	t ≤ 10s	R _{θJA}	16.7	25	°C/W
Maximum Junction-to-Ambient ^A	Steady-State		40	50	°C/W
Maximum Junction-to-Case ^D	Steady-State	R _{θJC}	2.5	3	°C/W



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

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Drain-Source Breakdown Voltage	BV_{DSS}	$I_D=-250\mu\text{A}$, $V_{GS}=0\text{V}$	-40			V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS}=-40\text{V}$, $V_{GS}=0\text{V}$			-1	μA
		$T_J=55^{\circ}\text{C}$			-5	μA
Gate-Body leakage current	I_{GSS}	$V_{DS}=0\text{V}$, $V_{GS}=\pm 20\text{V}$			± 100	nA
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}$, $I_D=-250\mu\text{A}$	-1.7	-2	-3	V
On state drain current	$I_{D(ON)}$	$V_{GS}=-10\text{V}$, $V_{DS}=-5\text{V}$	-30			A
Static Drain-Source On-Resistance	$R_{DS(ON)}$	$V_{GS}=-10\text{V}$, $I_D=-12\text{A}$		36	40	m Ω
		$V_{GS}=-4.5\text{V}$, $I_D=-8\text{A}$		40	50	m Ω
Forward Transconductance	g_{FS}	$V_{DS}=-5\text{V}$, $I_D=-12\text{A}$		22		S
Diode Forward Voltage	V_{SD}	$I_S=-1\text{A}$, $V_{GS}=0\text{V}$		-0.76	-1	V
Maximum Body-Diode Continuous Current	I_S				-12	A
Input Capacitance	C_{iss}	$V_{GS}=0\text{V}$, $V_{DS}=-20\text{V}$, $f=1\text{MHz}$		900	1125	pF
Output Capacitance	C_{oss}			97		pF
Reverse Transfer Capacitance	C_{rss}			68		pF
Gate resistance	R_g	$V_{GS}=0\text{V}$, $V_{DS}=0\text{V}$, $f=1\text{MHz}$		14		Ω
Total Gate Charge	$Q_g(-10\text{V})$	$V_{GS}=-10\text{V}$, $V_{DS}=-20\text{V}$ $I_D=-12\text{A}$		16.2	21	nC
Total Gate Charge	$Q_g(-4.5\text{V})$			7.2	9.4	nC
Gate Source Charge	Q_{gs}			3.8		nC
Gate Drain Charge	Q_{gd}			3.5		nC
Turn-On DelayTime	$t_{D(on)}$	$V_{GS}=-10\text{V}$, $V_{DS}=-20\text{V}$ $R_L=1.6\Omega$, $R_{GEN}=3\Omega$		6.2		ns
Turn-On Rise Time	t_r			8.4		ns
Turn-Off DelayTime	$t_{D(off)}$			44.8		ns
Turn-Off Fall Time	t_f			41.2		ns
Body Diode Reverse Recovery Time	t_{rr}	$I_F=-12\text{A}$, $dI/dt=100\text{A}/\mu\text{s}$		21.2		ns
Body Diode Reverse Recovery Charge	Q_{rr}	$I_F=-12\text{A}$, $dI/dt=100\text{A}/\mu\text{s}$		13.8		nC



- A: The value of $R_{\theta JA}$ is measured with the device in a still air environment with $T_A = 25^\circ\text{C}$. The power dissipation P_{DSM} and current rating I_{DSM} are based on $T_{J(MAX)} = 150^\circ\text{C}$, using $t \leq 10\text{s}$ junction-to-ambient thermal resistance.
- 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 $T_{J(MAX)} = 175^\circ\text{C}$. The SOA curve provides a single pulse rating.
- G: These tests are performed with the device mounted on 1 in² FR-4 board with 2oz. Copper, in a still air environment with $T_A = 25^\circ\text{C}$.
- H: The maximum current rating is limited by bond-wires.



7.1 Typical characteristic

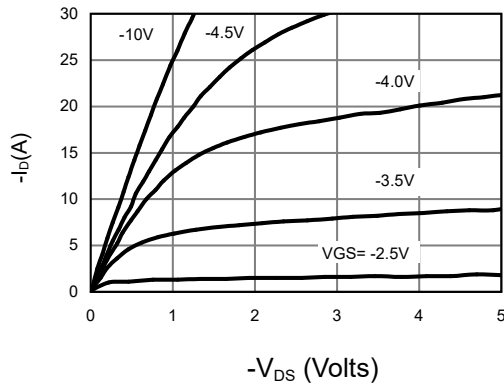


Figure 1: On-Region Characteristics

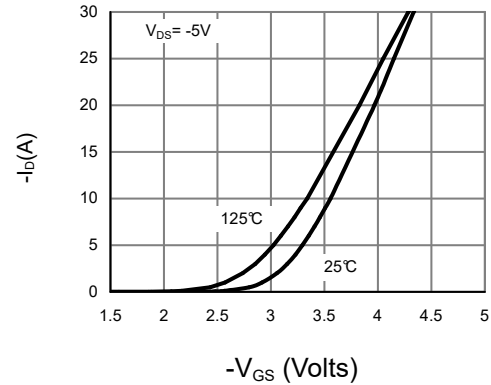


Figure 2: Transfer Characteristics

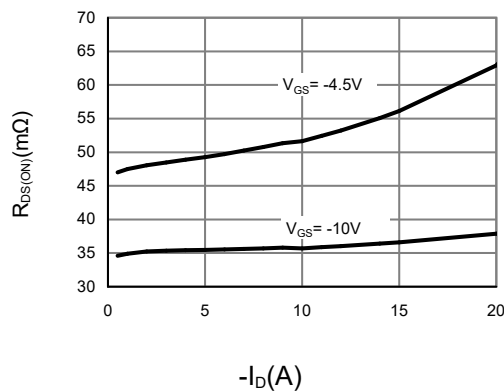


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

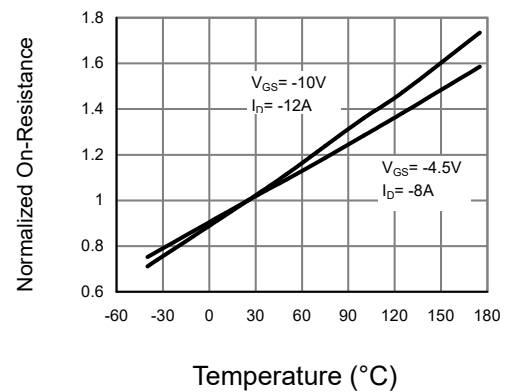


Figure 4: On-Resistance vs. Junction Temperature

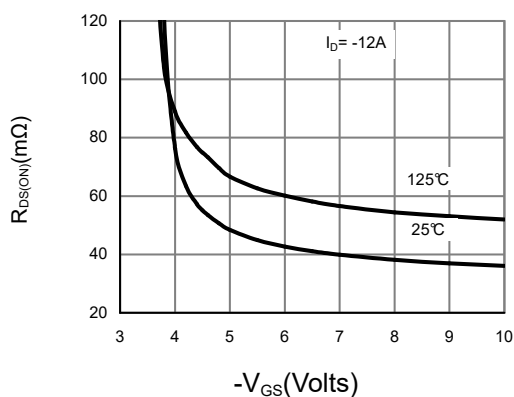


Figure 5: On-Resistance vs. Gate-Source Voltage

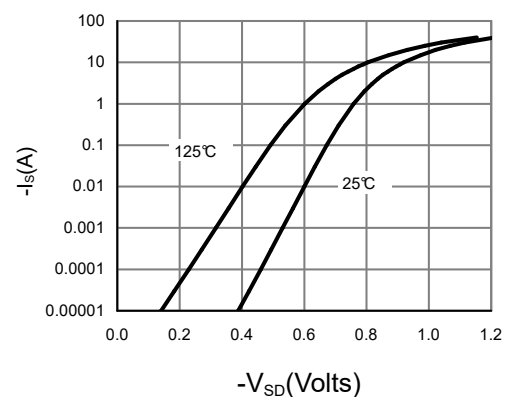


Figure 6: Body-Diode Characteristics



7.2 Typical characteristic

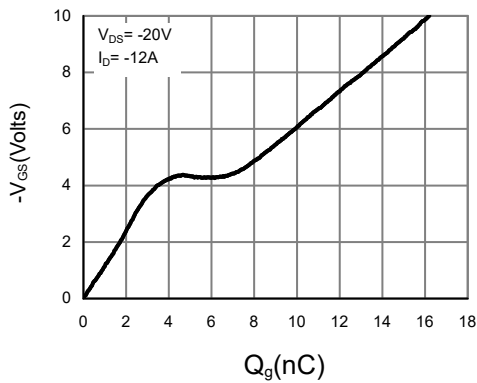


Figure 7: Gate-Charge Characteristics

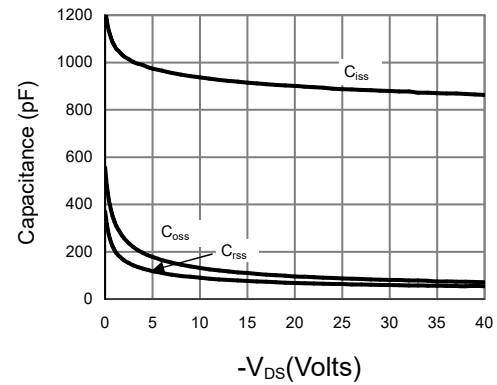


Figure 8: Capacitance Characteristics

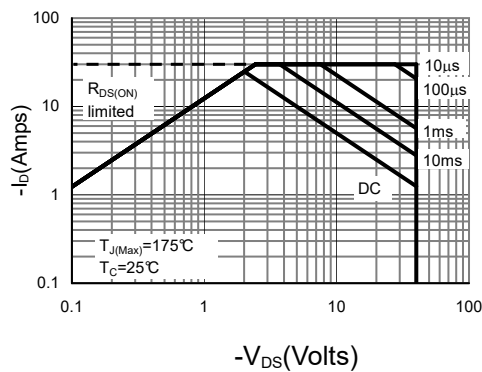


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

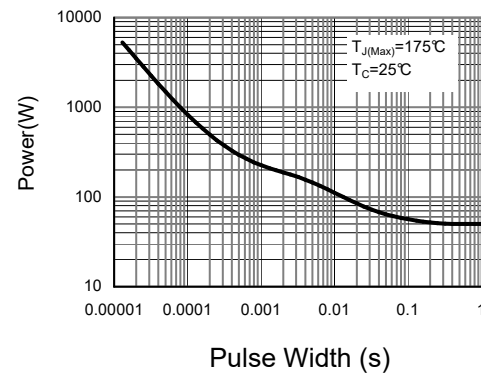


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

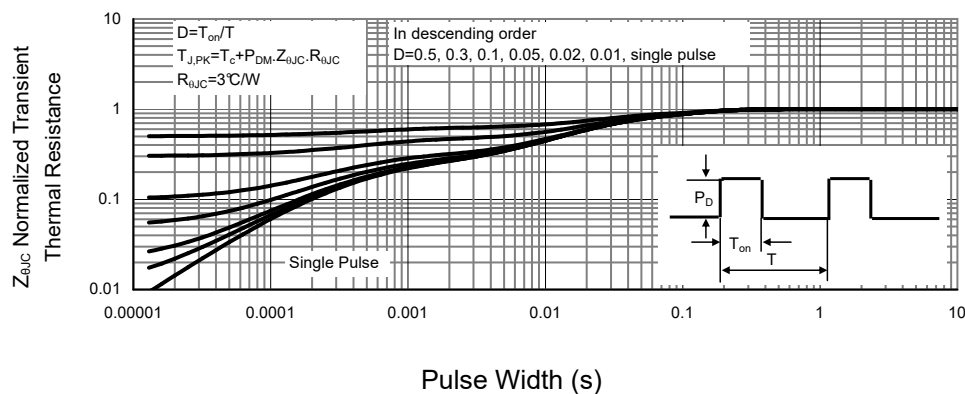


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)



7.3 Typical characteristic

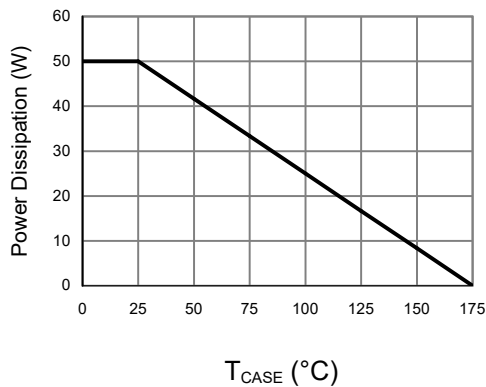


Figure 12: Power De-rating (Note B)

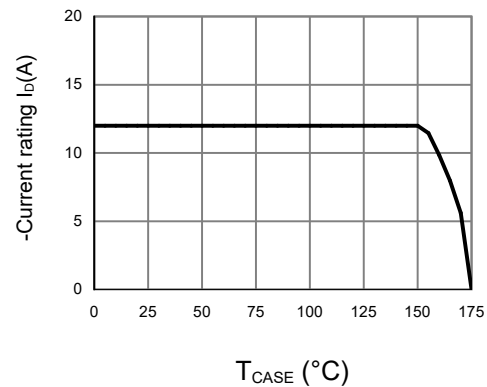


Figure 13: Current De-rating (Note B)

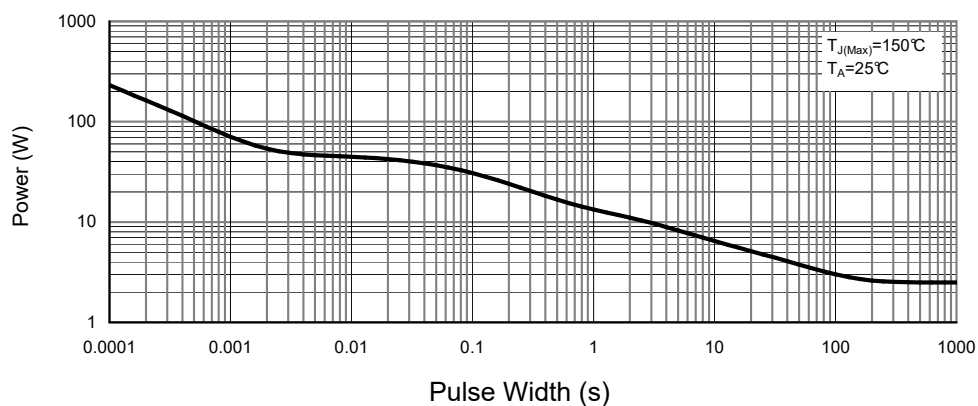


Figure 14: Single Pulse Power Rating Junction-to-Ambient (Note G)

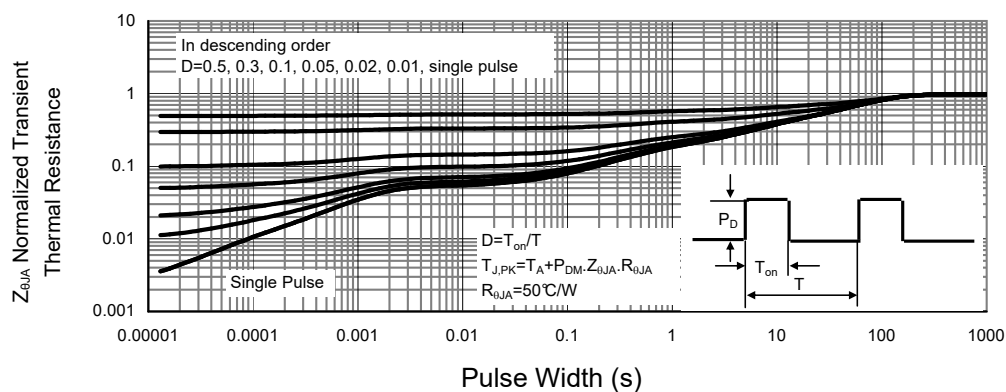
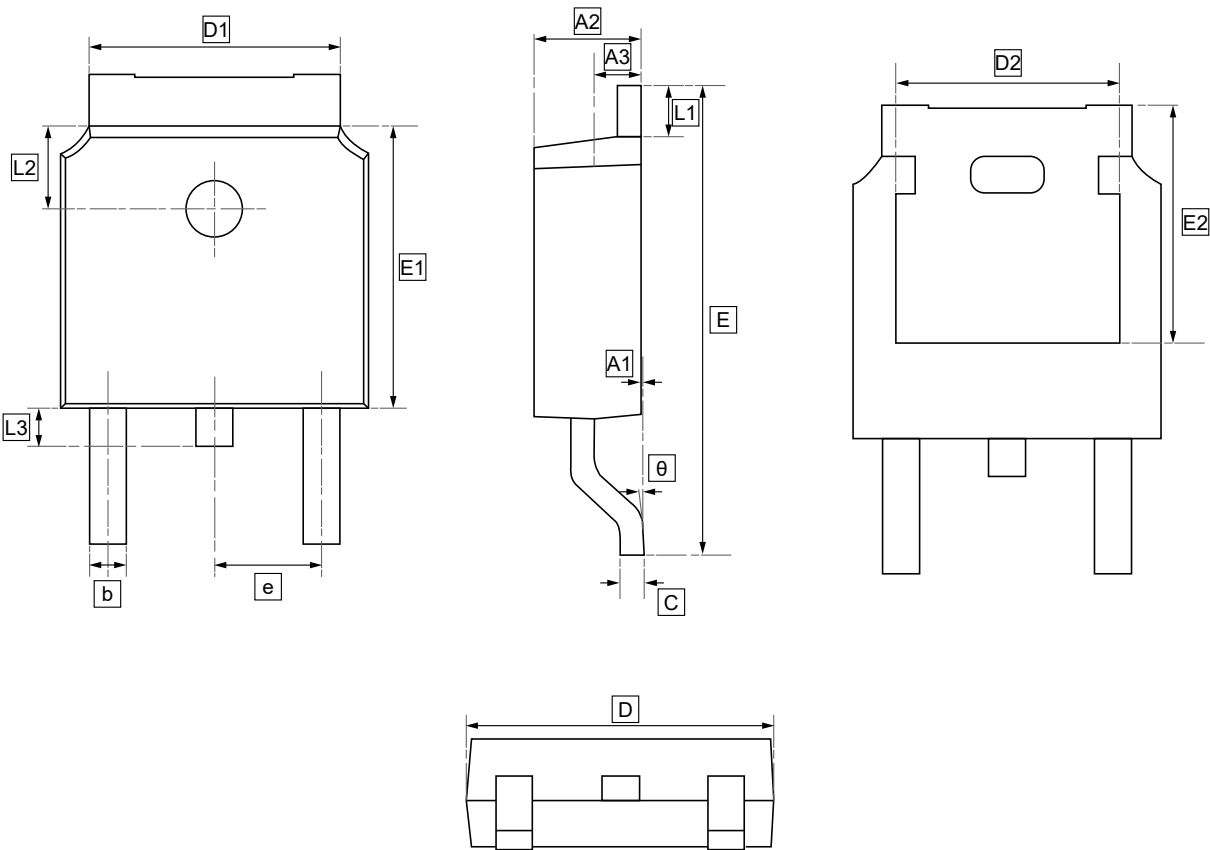


Figure 15: Normalized Maximum Transient Thermal Impedance (Note G)



8.TO-252 Package Outline Dimensions

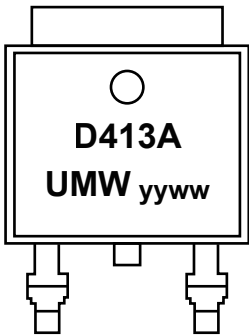


DIMENSIONS (mm are the original dimensions)

Symbol	A1	A2	A3	b	c	D	D1	D2	E	E1	E2	e	L1	L2	L3	θ
Min	0.00	2.18	0.90	0.65	0.46	6.35	4.95	4.32	9.40	5.97	5.21	2.286	0.89	1.70	0.60	0.00
Max	0.13	2.39	1.10	0.85	0.61	6.73	5.46	4.90	10.41	6.22	5.38		1.27	1.90	1.00	8.00



9.Ordering information



yy: Year Code
ww: Week Code

Order Code	Package	Base QTY	Delivery Mode
UMW AOD413A	TO-252	2500	Tape and reel



10.Disclaimer

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