

# AOT262L/AOB262L

60V N-Channel MOSFET

## **General Description**

- Trench Power MV MOSFET technology
- Low R<sub>DS(ON)</sub>
- Low Gate Charge
- Optimized for fast-switching applications

## **Product Summary**

 $\begin{array}{c} V_{DS} & \qquad \qquad 60V \\ I_{D} \; (at \; V_{GS} \!\!=\! 10V) & \qquad 140A \end{array} \label{eq:VDS}$ 

$$\begin{split} R_{DS(ON)} & (\text{at V}_{GS} = 10\text{V}) & < 3.0 \text{m}\Omega \quad (< 2.8 \text{m}\Omega^*) \\ R_{DS(ON)} & (\text{at V}_{GS} = 6\text{V}) & < 3.2 \text{m}\Omega \quad (< 3.0 \text{m}\Omega^*) \end{split}$$

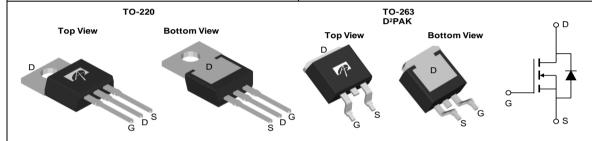
# **Applications**

Synchronus Rectification in DC/DC and AC/DC Converters

• Industrial and Motor Drive applications







Orderable Part Number	Package Type	Form	Minimum Order Quantity
AOT262L	TO-220	Tube	1000
AOB262L	TO-263	Tape & Reel	800

Parameter		Symbol	Maximum	Units	
Drain-Source Voltage		V <sub>DS</sub>	60	V	
Gate-Source Voltage		V <sub>GS</sub>	±20	V	
Continuous Drain	T <sub>C</sub> =25°C		140	A	
Current <sup>G</sup>	T <sub>C</sub> =100°C		110		
Pulsed Drain Current <sup>C</sup>		I <sub>DM</sub>	500		
Continuous Drain	T <sub>A</sub> =25°C		20		
Current	T <sub>A</sub> =70°C	IDSM	16	A	
Avalanche Current <sup>C</sup>		I <sub>AS</sub> , I <sub>AR</sub>	115	A	
Avalanche energy L=0.1mH <sup>C</sup>		E <sub>AS</sub> , E <sub>AR</sub>	661	mJ	
V <sub>DS</sub> Spike	Spike 10μs		72	V	
Peak diode recovery dv/dt		dv/dt	8	V/ns	
	T <sub>C</sub> =25°C	D	333	w	
Power Dissipation <sup>B</sup>	T <sub>C</sub> =100°C	P <sub>D</sub>	167		
	T <sub>A</sub> =25°C	Р	2.1	10/	
Power Dissipation A	T <sub>A</sub> =70°C	P <sub>DSM</sub>	1.3	W	
Junction and Storage Temperature Range		T <sub>J</sub> , T <sub>STG</sub>	-55 to 175	°C	

Thermal Characteristics						
Parameter		Symbol	Тур	Max	Units	
Maximum Junction-to-Ambient A	t ≤ 10s	$R_{\theta JA}$	12	15	°C/W	
Maximum Junction-to-Ambient AD	Steady-State	$\kappa_{\theta JA}$	48	60	°C/W	
Maximum Junction-to-Case	Steady-State	$R_{\theta JC}$	0.35	0.45	°C/W	

<sup>\*</sup> Surface mount package TO263



#### Electrical Characteristics (T<sub>.I</sub>=25°C unless otherwise noted)

$ \begin{array}{ c c c c } \hline l_{DSS} & Zero \ Gate \ Voltage \ Drain \ Current \\ \hline l_{GSS} & Gate-Body \ leakage \ current \\ \hline V_{DS}=0V, \ V_{DS}=\pm 20V \\ \hline V_{DS}=0V, \ V_{DS}=2V_{DS} \ V_{DS}=2V_{DS} \\ \hline V_{DS}=0V, \ V_{DS}=5V \\ \hline V_{DS}=10V, \ V_{DS}=20V \\ \hline V_{DS}=10V, \ V_{DS}=2V_{DS} \\ \hline V_{DS}=10V, \ V$	ol P	Parameter	Conditions	Min	Тур	Max	Units	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$								
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	D	Drain-Source Breakdown Voltage	$I_D=250\mu A,\ V_{GS}=0V$	60			V	
$\begin{array}{ c c c c c } \hline I_{GSS} & Gate-Body leakage current & V_{DS}=0V, V_{GS}=\pm 20V & 10 \\ \hline V_{GS(th)} & Gate Threshold Voltage & V_{DS}=V_{GS} I_{D}=250\mu A & 2.2 & 2.7 & 3.3 \\ \hline I_{D(DN)} & On state drain current & V_{GS}=10V, V_{DS}=5V & 500 \\ \hline & V_{GS}=10V, V_{DS}=5V & 500 & 2.2 & 3.6 \\ \hline & V_{GS}=10V, I_{D}=20A & 2.2 & 3.6 \\ \hline & V_{GS}=6V, I_{D}=20A & 2.5 & 3.3 \\ \hline & V_{GS}=6V, I_{D}=20A & 2.0 & 2.3 \\ \hline & V_{GS}=6V, I_{D}=20A & 2.0 & 2.3 \\ \hline & V_{GS}=6V, I_{D}=20A & 2.0 & 2.3 \\ \hline & V_{SD} & Diode Forward Voltage & I_{S}=1A, V_{GS}=0V & 0.65 & 1 \\ \hline & I_{S} & Maximum Body-Diode Continuous Current & 3 & 14 \\ \hline & DYNAMIC PARAMETERS & 25 & 32 & 55 \\ \hline & C_{ISS} & Input Capacitance & V_{GS}=0V, V_{DS}=30V, f=1MHz & 0.5 & 1 & 1.5 \\ \hline & SWITCHING PARAMETERS & 29 & Gate resistance & V_{GS}=0V, V_{DS}=30V, I_{D}=20A & 30 \\ \hline & Q_{gG} & Gate Drain Charge & V_{GS}=10V, V_{DS}=30V, R_{L}=1.5\Omega, & 22 \\ \hline & U_{CS}=10V, V_{DS}=30V, R_{L}=1.5\Omega, & 22 \\ \hline & U_{CS}=10$	7.	Zero Gate Voltage Drain Current	V <sub>DS</sub> =60V, V <sub>GS</sub> =0V			1	μА	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	IDSS Z		T <sub>J</sub> =55°C			5		
I <sub>D(ON)</sub>	G	Gate-Body leakage current	$V_{DS}$ =0V, $V_{GS}$ = ±20V			100	nA	
I <sub>D(ON)</sub>	G	Gate Threshold Voltage	$V_{DS}=V_{GS} I_{D}=250\mu A$	2.2	2.7	3.2	V	
$R_{DS(ON)} \  \   \text{Static Drain-Source On-Resistance} \  \   \begin{array}{c ccccccccccccccccccccccccccccccccccc$		On state drain current	$V_{GS}$ =10V, $V_{DS}$ =5V	500			Α	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$			V <sub>GS</sub> =10V, I <sub>D</sub> =20A		2.2	3.0		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$			TO220 T <sub>J</sub> =125°C		3.6			
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$			V <sub>GS</sub> =6V, I <sub>D</sub> =20A					
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	0.	Static Drain-Source On-Resistance	TO220		2.5	3.2	mΩ	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	R <sub>DS(ON)</sub> Static Drain-Source On-Resistance	Static Drain-Source On-Ivesistance	$V_{GS}=10V$ , $I_D=20A$				1112.2	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$					2.0	2.8		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$			V <sub>GS</sub> =6V, I <sub>D</sub> =20A					
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$			TO263		2.3	3.0		
$\begin{array}{ c c c c }\hline I_S & Maximum Body-Diode Continuous Current & & & 14\\ \hline \textbf{DYNAMIC PARAMETERS} \\ \hline C_{iss} & Input Capacitance & V_{GS}=0V, V_{DS}=30V, f=1MHz & 830 & 1040 & 138\\ \hline C_{rss} & Reverse Transfer Capacitance & V_{GS}=0V, V_{DS}=30V, f=1MHz & 0.5 & 1 & 1.8\\ \hline R_g & Gate resistance & V_{GS}=0V, V_{DS}=0V, f=1MHz & 0.5 & 1 & 1.8\\ \hline \textbf{SWITCHING PARAMETERS} \\ \hline Q_g(10V) & Total Gate Charge & V_{GS}=10V, V_{DS}=30V, I_D=20A & 30\\ \hline Q_{gd} & Gate Drain Charge & V_{GS}=10V, V_{DS}=30V, I_D=20A & 30\\ \hline Q_{gd} & Gate Drain Charge & 5\\ \hline t_{D(on)} & Turn-On DelayTime & V_{GS}=10V, V_{DS}=30V, R_L=1.5\Omega, & 22\\ \hline \end{array}$	F	Forward Transconductance	$V_{DS}$ =5V, $I_D$ =20A		80		S	
$ \begin{array}{ c c c c c } \hline \textbf{DYNAMIC PARAMETERS} \\ \hline C_{iss} & Input Capacitance \\ \hline C_{oss} & Output Capacitance \\ \hline C_{rss} & Reverse Transfer Capacitance \\ \hline R_g & Gate resistance \\ \hline Q_g(10V) & Total Gate Charge \\ \hline Q_{gs} & Gate Drain Charge \\ \hline t_{D(on)} & Turn-On DelayTime \\ \hline t_r & Turn-On Rise Time \\ \hline \hline C_{iss} & Input Capacitance \\ \hline V_{GS}=0V, V_{DS}=30V, f=1MHz \\ \hline V_{GS}=0V, V_{DS}=30V, f=1MHz \\ \hline 0.5 & 1 & 1.8 \\ \hline $					0.65	1	V	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	М	Maximum Body-Diode Continuous Current <sup>G</sup>				140	Α	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	MIC P	PARAMETERS						
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	In	nput Capacitance		6500	8140	9800	pF	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	0	Output Capacitance	$V_{GS}$ =0V, $V_{DS}$ =30V, f=1MHz	830	1040	1350	pF	
	R	Reverse Transfer Capacitance		25	32	55	pF	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	G	Gate resistance	$V_{GS}$ =0V, $V_{DS}$ =0V, f=1MHz	0.5	1	1.5	Ω	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	CHING	G PARAMETERS						
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	/) To	Total Gate Charge		75	95	115	nC	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	G	Gate Source Charge	$V_{GS}$ =10V, $V_{DS}$ =30V, $I_{D}$ =20A		30		nC	
$t_r$ Turn-On Rise Time $V_{GS}$ =10V, $V_{DS}$ =30V, $R_L$ =1.5 $\Omega$ , 22	G	Gate Drain Charge			5		nC	
0 00	Ti	Turn-On DelayTime			27		ns	
D 00	To	Turn-On Rise Time	$V_{GS}$ =10V, $V_{DS}$ =30V, $R_L$ =1.5 $\Omega$ ,		22		ns	
$t_{D(off)}$   Turn-Off DelayTime   $k_{GEN}=3\Omega$   47	T	Turn-Off DelayTime	$R_{GEN}=3\Omega$		47		ns	
t <sub>f</sub> Turn-Off Fall Time 8	To	Turn-Off Fall Time			8		ns	
$t_{rr}$ Body Diode Reverse Recovery Time $I_F$ =20A, $dI/dt$ =500A/ $\mu$ s 21 30 39	В	Body Diode Reverse Recovery Time	I <sub>F</sub> =20A, dI/dt=500A/μs	21	30	39	ns	
$Q_{rr}$ Body Diode Reverse Recovery Charge $I_F$ =20A, $dI/dt$ =500A/ $\mu$ s 130 185 24	B	Body Diode Reverse Recovery Charge	I <sub>F</sub> =20A, dI/dt=500A/μs	130	185	240	nC	

A. The value of  $R_{0JA}$  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. The Power dissipation P<sub>DSM</sub> is based on R <sub>BJA</sub> and the maximum allowed junction temperature of 150 °C. The value in any given application depends on the user's specific board design, and the maximum temperature of 175° C may be used if the PCB allows it.

- D. The  $R_{\theta JA}$  is the sum of the thermal impedence from junction to case  $R_{\theta JC}$  and case to ambient.
- E. The static characteristics in Figures 1 to 6 are obtained using <300μs pulses, duty cycle 0.5% max.
- F. These curves are based on the junction-to-case thermal impedence which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of T<sub>J(MAX)</sub>=175° C. The SOA curve provides a single pulse rating.

  G. The maximum current rating is package limited.
- 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<sub>A</sub>=25° C.

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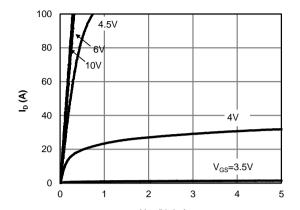
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B. The power dissipation P<sub>D</sub> is based on T<sub>J(MAX)</sub>=175° C, using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.

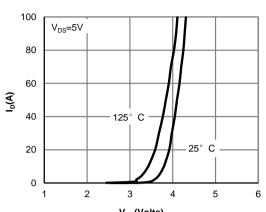
C. Repetitive rating, pulse width limited by junction temperature T<sub>J(MAX)</sub>=175° C. Ratings are based on low frequency and duty cycles to keep initial T<sub>J</sub> =25° C.



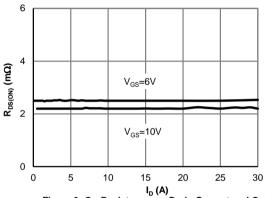
#### TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS



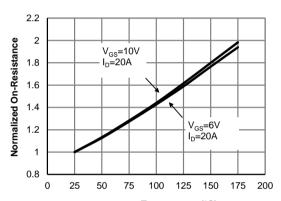
V<sub>DS</sub> (Volts) Fig 1: On-Region Characteristics (Note E)



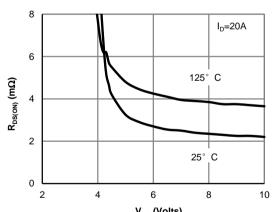
V<sub>GS</sub>(Volts)
Figure 2: Transfer Characteristics (Note E)



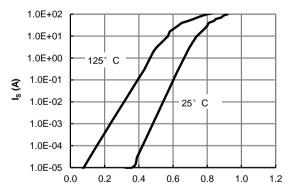
 ${\rm I_D}\left({\rm A}\right)$  Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)



Temperature (°C)
Figure 4: On-Resistance vs. Junction Temperature
(Note E)



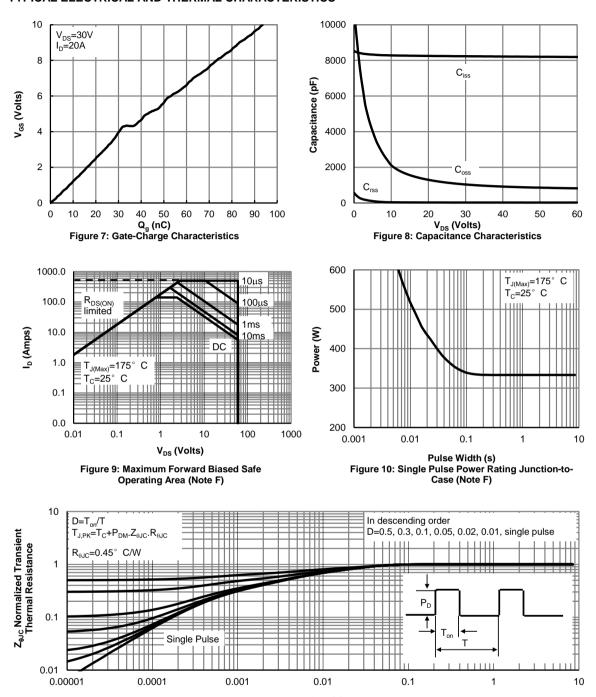
V<sub>GS</sub> (Volts)
Figure 5: On-Resistance vs. Gate-Source Voltage
(Note E)



V<sub>SD</sub> (Volts)
Figure 6: Body-Diode Characteristics (Note E)



#### TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

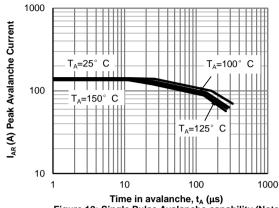


Pulse Width (s)
Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

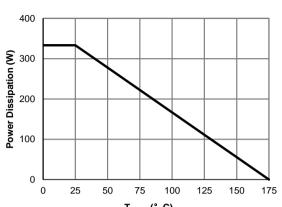
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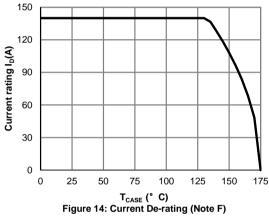
#### TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

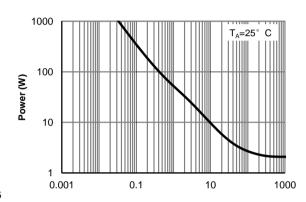


Time in avalanche,  $t_A$  ( $\mu$ s) Figure 12: Single Pulse Avalanche capability (Note C)

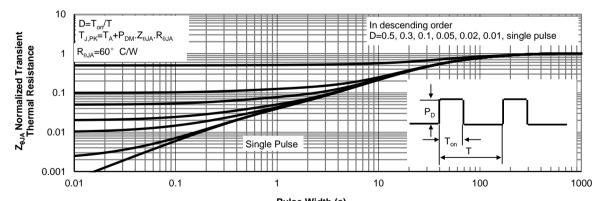


T<sub>CASE</sub> (° C)
Figure 13: Power De-rating (Note F)





Pulse Width (s)
Figure 15: Single Pulse Power Rating Junction-toAmbient (Note H)

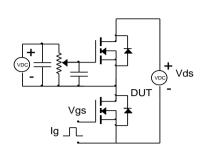


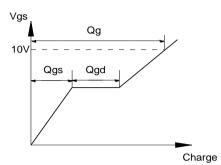
Pulse Width (s)
Figure 16: Normalized Maximum Transient Thermal Impedance (Note H)

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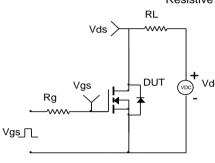


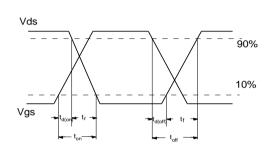
## Gate Charge Test Circuit & Waveform



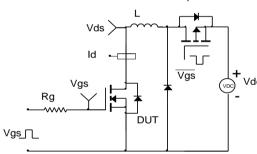


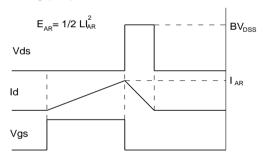
# Resistive Switching Test Circuit & Waveforms





## Unclamped Inductive Switching (UIS) Test Circuit & Waveforms





# Diode Recovery Test Circuit & Waveforms

