AOT2502L/AOB2502L

150V N-Channel MOSFET

General Description

- Trench Power MV MOSFET technology
- Low $R_{DS(ON)}$
- Low Gate Charge
- Optimized for fast-switching applications

Applications

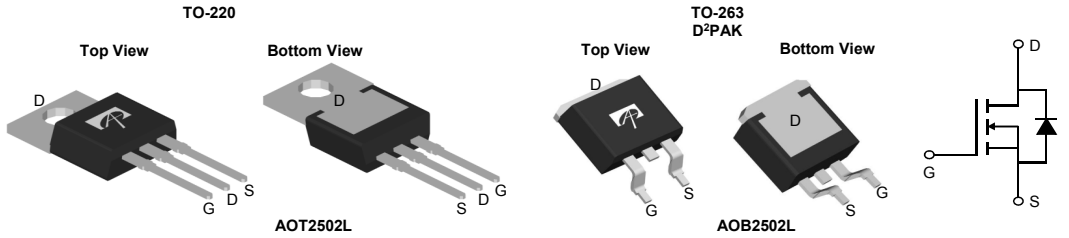
- Synchronous Rectification in DC/DC and AC/DC Converters
- Industrial and Motor Drive applications

Product Summary

V_{DS}	150V
I_D (at V_{GS}=10V)	106A
$R_{DS(ON)}$ (at V_{GS}=10V)	< 11mΩ (10.7mΩ*)

100% UIS Tested
100% Rg Tested

Green Product



Orderable Part Number	Package Type	Form	Minimum Order Quantity
AOT2502L	TO-220	Tube	1000
AOB2502L	TO-263	Tape & Reel	800

Absolute Maximum Ratings T_A=25°C unless otherwise noted

Parameter		Symbol	Maximum	Units
Drain-Source Voltage		V_{DS}	150	V
Gate-Source Voltage		V_{GS}	±20	V
Continuous Drain Current	T_C=25°C	I_D	106	A
	T_C=100°C		67	
Pulsed Drain Current [C]		I_{DM}	250	
Continuous Drain Current	T_A=25°C	I_{DSM}	18.5	A
	T_A=70°C		14.5	
Avalanche Current [C]		I_{AS}	40	A
Avalanche energy L=0.3mH [C]		E_{AS}	240	mJ
V_{DS} Spike	10µs	V_{SPIKE}	180	V
Power Dissipation [B]	T_C=25°C	P_D	277	W
	T_C=100°C		111	
Power Dissipation [A]	T_A=25°C	P_{DSM}	8.3	W
	T_A=70°C		5.3	
Junction and Storage Temperature Range		T_J, T_{STG}	-55 to 150	°C

Thermal Characteristics

Parameter		Symbol	Typ	Max	Units
Maximum Junction-to-Ambient [A]	t ≤ 10s	$R_{\theta JA}$	12	15	°C/W
Maximum Junction-to-Ambient [A D]	Steady-State		50	60	°C/W
Maximum Junction-to-Case	Steady-State	$R_{\theta JC}$	0.35	0.45	°C/W

* Surface mount package TO-263

Electrical Characteristics (T_J=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
BV_{DSS}	Drain-Source Breakdown Voltage	I_D=250µA, VGS=0V	150			V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=150V, V_{GS}=0V			1	µA
		T_J=55°C			5	
I_{GSS}	Gate-Body leakage current	V_{DS}=0V, V_{GS}=±20V			±100	nA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=$V_{GS,}$ I_D=250µA	3.5	4.3	5.1	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=10V, I_D=20A		9.2	11	mΩ
		TO-220 T_J=125°C		17.8	21.5	
		V_{GS}=10V, I_D=20A TO-263		8.9	10.7	mΩ
g_{FS}	Forward Transconductance	V_{DS}=5V, I_D=20A		50		S
V_{SD}	Diode Forward Voltage	I_S=1A,V_{GS}=0V		0.7	1	V
I_S	Maximum Body-Diode Continuous Current				106	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=75V, f=1MHz		3010		pF
C_{oss}	Output Capacitance			345		pF
C_{rss}	Reverse Transfer Capacitance			14		pF
R_g	Gate resistance	f=1MHz	1	2	3	Ω
SWITCHING PARAMETERS						
Q_g(10V)	Total Gate Charge	V_{GS}=10V, V_{DS}=75V, I_D=20A		43	60	nC
Q_{gs}	Gate Source Charge			18		nC
Q_{gd}	Gate Drain Charge			10		nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=10V, V_{DS}=75V, R_L=3.75Ω, R_{GEN}=3Ω		19		ns
t_r	Turn-On Rise Time			24		ns
$t_{D(off)}$	Turn-Off DelayTime			30		ns
t_f	Turn-Off Fall Time			8.5		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=20A, dI/dt=500A/µs		75		ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=20A, dI/dt=500A/µs		880		nC

A. The value of $R_{\theta JA}$ is measured with the device mounted on 1in² FR-4 board with 2oz. Copper, in a still air environment with T_A =25° C. The Power dissipation P_{DSM} is based on $R_{\theta JA}$ t≤ 10s 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 150° C may be used if the PCB allows it.
B. The power dissipation P_D is based on $T_{J(MAX)}$=150° 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. Single pulse width limited by junction temperature $T_{J(MAX)}$=150° 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 <300µs 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 $T_{J(MAX)}$=150° 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 in² FR-4 board with 2oz. Copper, in a still air environment with T_A=25° C.

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

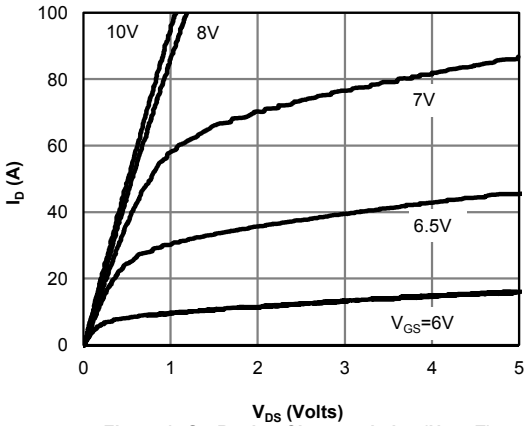


Figure 1: On-Region Characteristics (Note E)

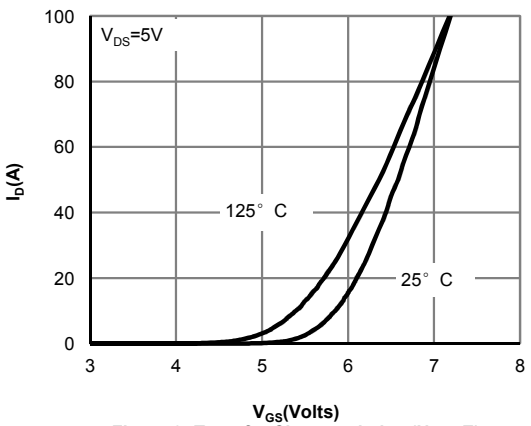


Figure 2: Transfer Characteristics (Note E)

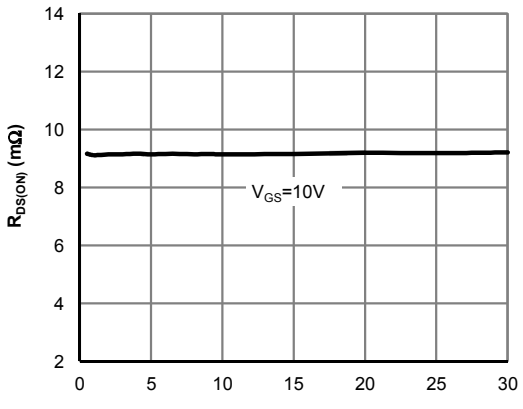


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

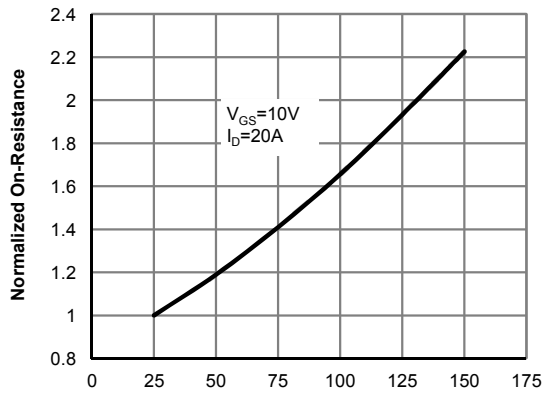


Figure 4: On-Resistance vs. Junction Temperature (Note E)

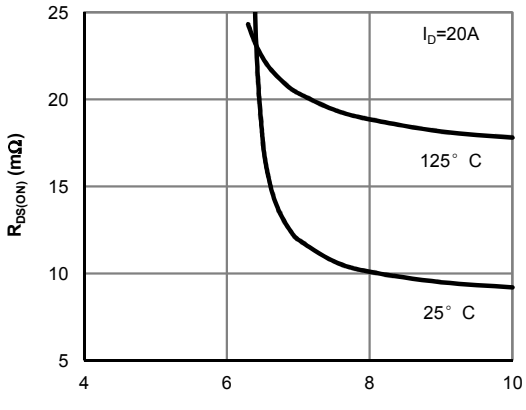


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

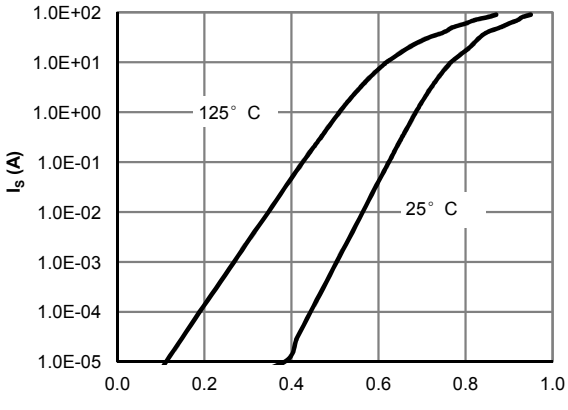


Figure 6: Body-Diode Characteristics (Note E)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

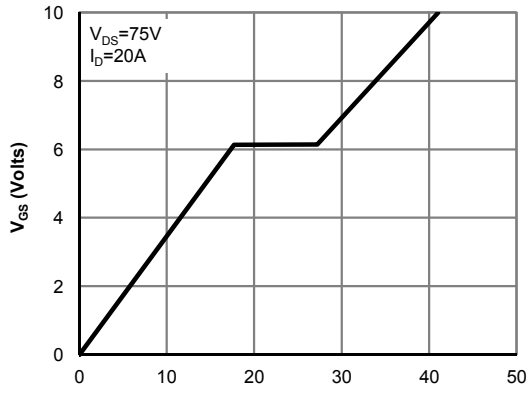


Figure 7: Gate-Charge Characteristics

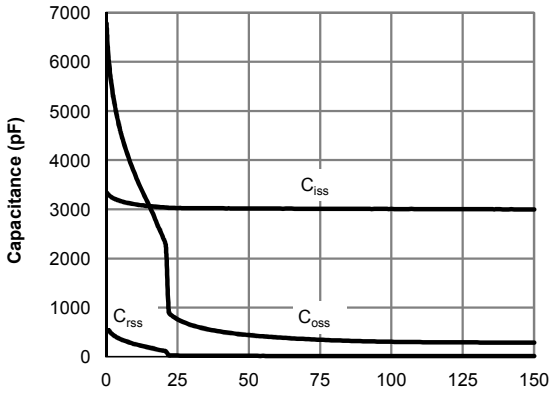


Figure 8: Capacitance Characteristics

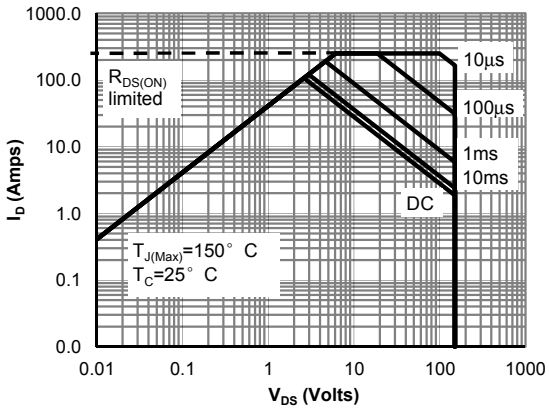


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

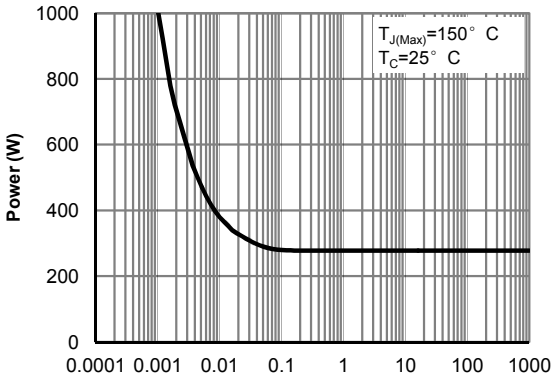


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

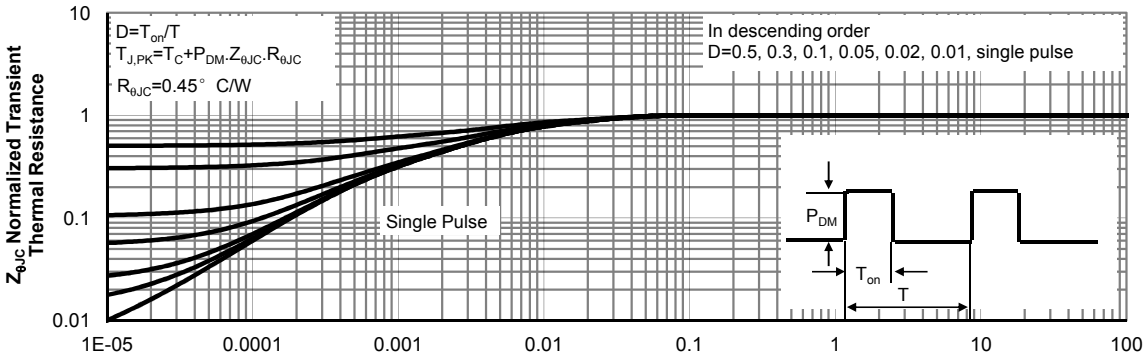


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

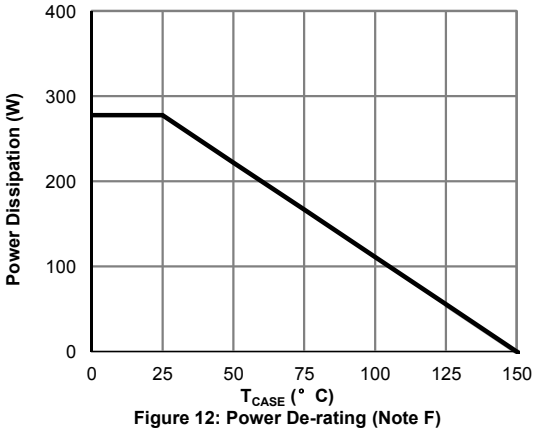


Figure 12: Power De-rating (Note F)

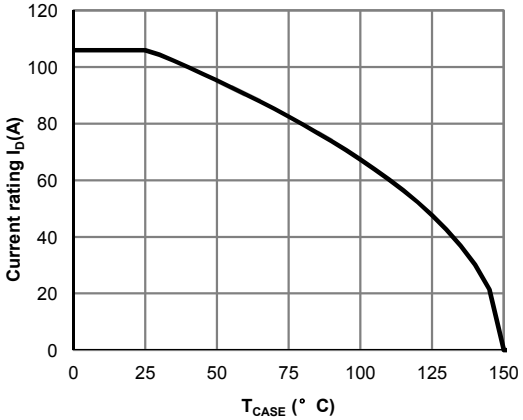


Figure 13: Current De-rating (Note F)

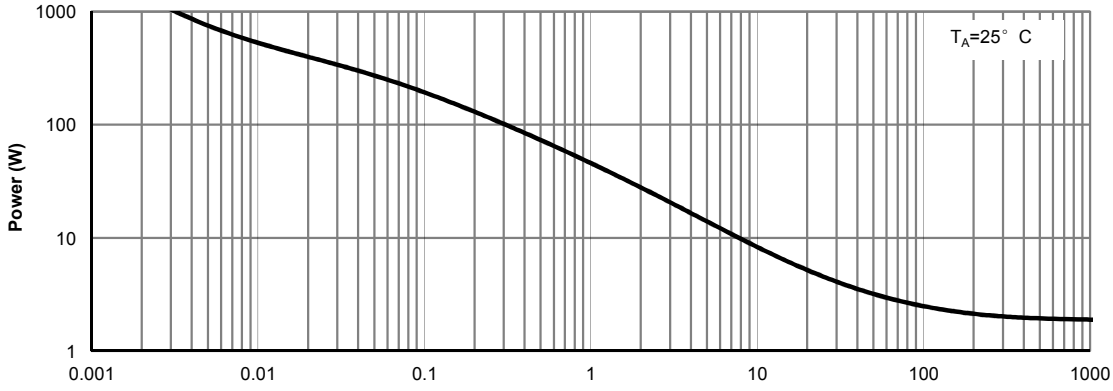


Figure 14: Single Pulse Power Rating Junction-to-Ambient (Note H)

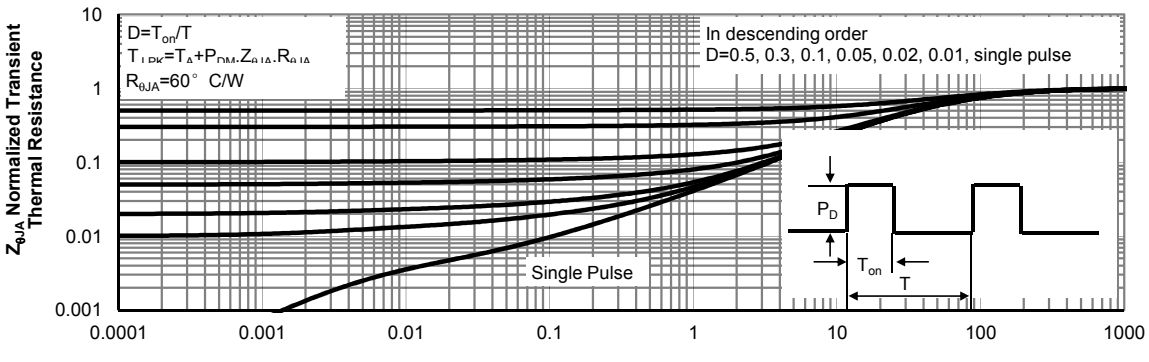
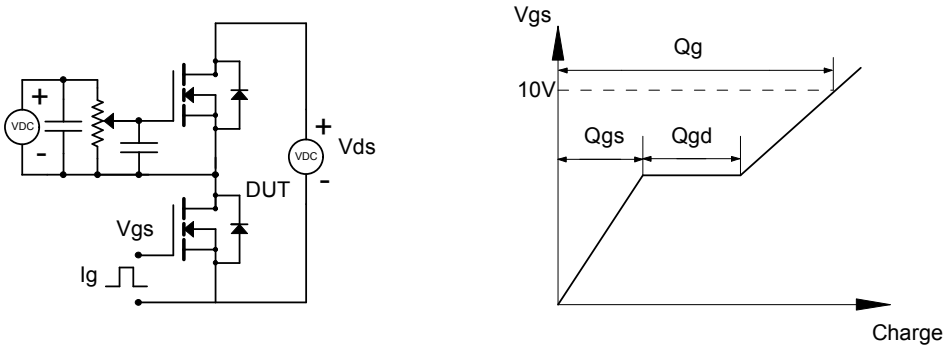
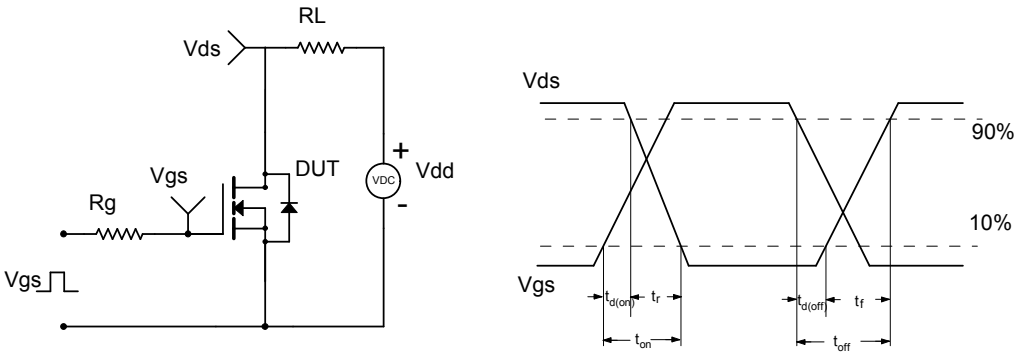


Figure 15: Normalized Maximum Transient Thermal Impedance (Note H)

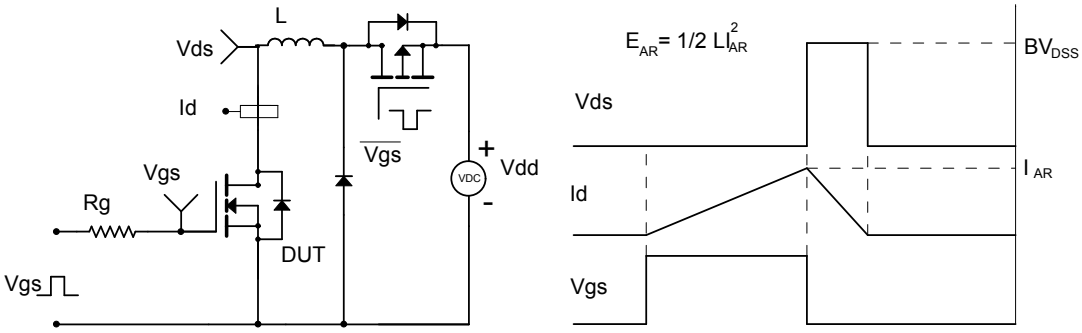
Gate Charge Test Circuit & Waveform



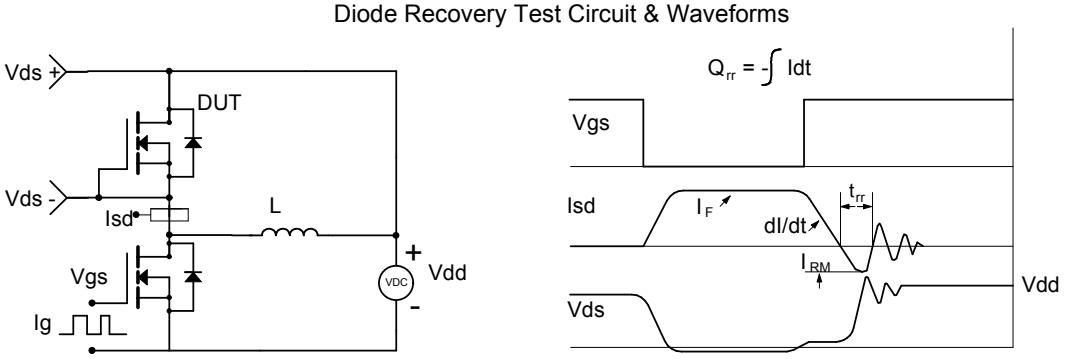
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



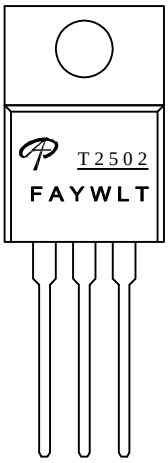
Diode Recovery Test Circuit & Waveforms



ALPHA & OMEGA SEMICONDUCTOR

Document No.	PD-02251
Version	A
Title	AOT2502L Marking Description

TO220 PACKAGE MARKING DESCRIPTION



Green product

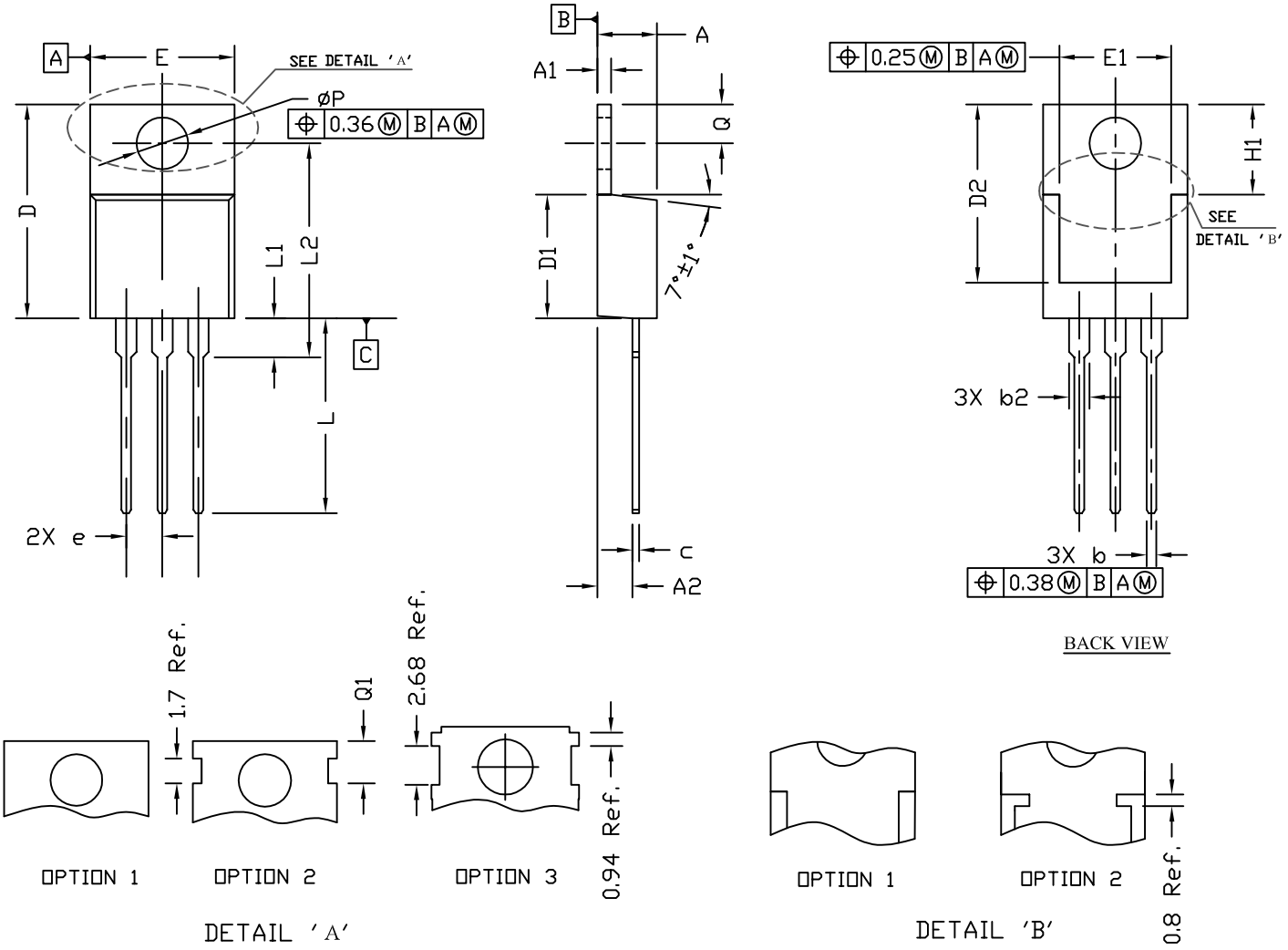
NOTE:
LOGO - AOS Logo
T2502 - Part number code
F - Fab code
A - Assembly location code
Y - Year code
W - Week code
L&T - Assembly lot code

PART NO.	DESCRIPTION	CODE
AOT2502L	Green product	T2502

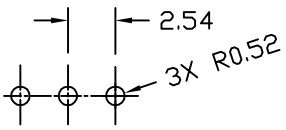
ALPHA & OMEGA SEMICONDUCTOR

Document No.	PO-00015
Version	L

TO220 PACKAGE OUTLINE



RECOMMENDATION OF HOLE PATTERN



UNIT: mm

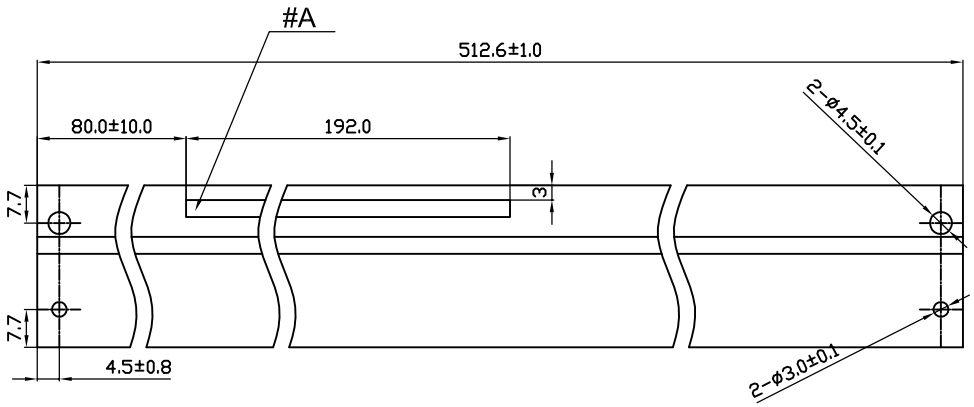
SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	4.30	4.45	4.72	0.169	0.175	0.186
A1	1.15	1.27	1.40	0.045	0.050	0.055
A2	2.20	2.67	2.90	0.087	0.105	0.114
b	0.69	0.81	0.95	0.027	0.032	0.037
b2	1.17	1.37	1.45	0.046	0.050	0.068
c	0.36	0.38	0.60	0.014	0.015	0.024
D	14.50	15.44	15.80	0.571	0.608	0.622
D1	8.59	9.14	9.65	0.338	0.360	0.380
D2	11.43	11.73	12.48	0.450	0.462	0.491
e	2.54 BSC			0.100 BSC.		
E	9.66	10.03	10.54	0.380	0.395	0.415
E1	6.22	---	---	0.245	---	---
H1	6.10	6.30	6.50	0.240	0.248	0.256
L	12.27	12.82	14.27	0.483	0.505	0.562
L1	2.47	---	3.90	0.097	---	0.154
L2	---	---	16.70	---	---	0.657
Q	2.59	2.74	2.89	0.102	0.108	0.114
øP	3.50	3.84	3.89	0.138	0.151	0.153
Q1	2.70	---	2.90	0.106	---	0.114

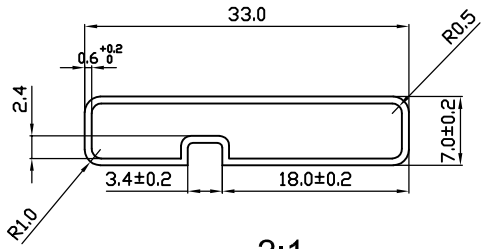
NOTE
1. PACKAGE BODY SIZES EXCLUDE MOLD FLASH AND GATE BURRS. MOLD FLASH SHOULD BE LESS THAN 6 MIL.
2. TOLERANCE 0.100 MILLIMETERS UNLESS OTHERWISE SPECIFIED.
3. CONTROLLING DIMENSION IS MILLIMETER. CONVERTED INCH DIMENSIONS ARE NOT NECESSARILY EXACT.

ALPHA & OMEGA SEMICONDUCTOR

REV.	DATE	DESCRIPTION	DRG.
A		NEW ISSUE	

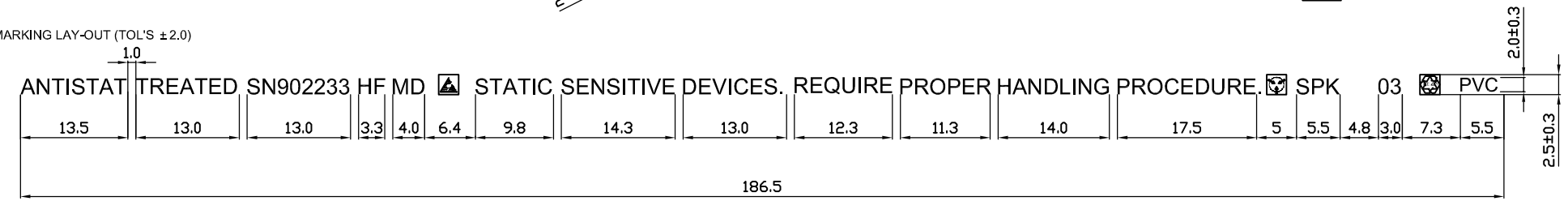
TO220/TO262 PLASTIC TUBE DRAWING





2:1

#A MARKING LAY-OUT (TOL'S ±2.0)



2:1

NOTE

1. TUBE
   - MATERIAL : P.V.C
   - COLOR : TRANSPARENCY, RED, YELLOW
   - MARKING #A : 6 MONTHS, BLACK COLOR
     LETTER STYLE : Arial
   - CAMBAR : 1.5 MAX
2. PIN
   - COLOR : GREEN (ONE PIN MUST BE INSERTED IN LEFT-SIDE OF " ANTISTATIC~" AND ANOTHER PIN IS FREE.)
3. ALL UNSPECIFICATED SPECIFICATIONS FOLLOW TUBE GENERAL SPEC.
   UNSPECIFICATED TOLERANCE ± 0.2
4. PACKING Q'TY :

PKG	Q'TY(PCS)
TO220/ TO262	50

ALPHA & OMEGA SEMICONDUCTOR		TITLE: TO220/TO262 TUBE DRAWING	
DRAWN BY	SIGNATURE		
APPROVED BY	SIGNATURE	UNIT: MM	PAGE: 1 OF 1
SCALE: N.T.S.	PROJECTION	DRAWING NUMBER: TR-00060	VENDOR CODE: N / REV.: B

AOS Semiconductor
Product Reliability Report

AOT2502L, rev A

Plastic Encapsulated Device

ALPHA & OMEGA Semiconductor, Inc

www.aosmd.com

This AOS product reliability report summarizes the qualification result for AOT2502L. Accelerated environmental tests are performed on a specific sample size, and then followed by electrical test at end point. Review of final electrical test result confirms that AOT2502L passes AOS quality and reliability requirements. The released product will be categorized by the process family and be routine monitored for continuously improving the product quality.

Table of Contents:

I. Product Description:

• Trench Power MV MOSFET technology
• Low $R_{DS(ON)}$
• Low Gate Charge
• Optimized for fast-switching applications

Details refer to the datasheet.

II. Die / Package Information:

	AOT2502L
Process	Standard sub-micron 150V N-Channel MOSFET
Package Type	TO220
Lead Frame	Bare Cu
Die Attach	Solder Paste
Bond	Al wire
Mold Material	Epoxy resin with silica filler

III. Reliability Stress Test Summary and Results

Test Item	Test Condition	Time Point	Total Sample Size	Number of Failures	Reference Standard
HTGB	Temp = 150°C , Vgs=100% of Vgsmax	168 / 500 / 1000 hours	924 pcs	0	JESD22-A108
HTRB	Temp = 150°C , Vds=80% of Vdsmax	168 / 500 / 1000 hours	924 pcs	0	JESD22-A108
HAST	130°C , 85%RH, 33.3 psia, Vds = 80% of Vdsmax up to 42V	96 hours	924 pcs	0	JESD22-A110
H3TRB	85°C , 85%RH, Vds = 80% of Vdsmax up to 100V	1000 hours	924 pcs	0	JESD22-A101
Autoclave	121°C , 29.7psia, RH=100%	96 hours	924 pcs	0	JESD22-A102
Temperature Cycle	-65°C to 150°C , air to air,	250 / 500 cycles	924 pcs	0	JESD22-A104
HTSL	Temp = 150°C	1000 hrs	924 pcs	0	JESD22-A103
Power Cycling	Δ Tj = 100°C 3.5min on/3.5min off	8572 cycles	693 pcs	0	AEC Q101
Resistance to Solder Heat	Temp = 260°C	10 seconds	30 pcs	0	JESD22-B106

Note: The reliability data presents total of available generic data up to the published date.

IV. Reliability Evaluation

FIT rate (per billion): 1.91
MTTF = 59839 years

The presentation of FIT rate for the individual product reliability is restricted by the actual burn-in sample size. Failure Rate Determination is based on JEDEC Standard JESD 85. FIT means one failure per billion hours.

Failure Rate = $Chi^2 \times 10^9$ **/ [**2 (N) (H) (Af)**] =** 1.91
MTTF = 10^9 / FIT = 59839 years

Chi² = Chi Squared Distribution, determined by the number of failures and confidence interval
N = Total Number of units from burn-in tests
H = Duration of burn-in testing
Af = Acceleration Factor from Test to Use Conditions (Ea = 0.7eV and Tuse = 55°C)
Acceleration Factor [**Af**] = **Exp** [Ea / **k** (1/Tj u – 1/Tj s)]

Acceleration Factor ratio list:

	55 deg C	70 deg C	85 deg C	100 deg C	115 deg C	130 deg C	150 deg C
Af	259	87	32	13	5.64	2.59	1

Tj s = Stressed junction temperature in degree (Kelvin), K = C+273.16
Tj u =The use junction temperature in degree (Kelvin), K = C+273.16
k = Boltzmann's constant, 8.617164 X 10^{-5}eV / K