ALPHA & OMEGA SEMICONDUCTOR

AOD2544

150V N-Channel AlphaMOS

General Description

- Latest Trench Power AlphaMOS (αMOS MV) technology
- Very Low $R_{DS(ON)}$
- Low Gate Charge
- Optimized for fast-switching applications
- RoHS and Halogen-Free Compliant

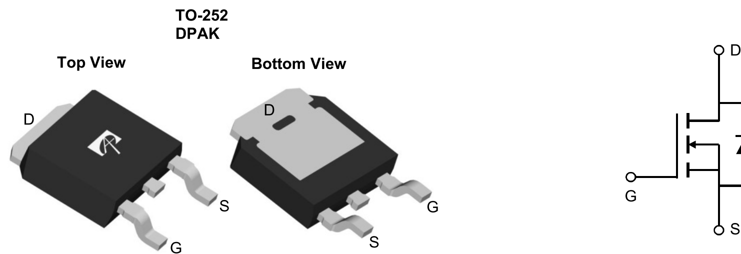
Product Summary

V_{DS}	150V
I_D (at V_{GS}=10V)	23A
$R_{DS(ON)}$ (at V_{GS}=10V)	< 54mΩ
$R_{DS(ON)}$ (at V_{GS}=4.5V)	< 66mΩ

100% UIS Tested
100% Rg Tested

Application

- Synchronus Rectification in DC/DC and AC/DC Converters
- Isolated DC/DC Converters in Telecom and Industrial



Orderable Part Number	Package Type	Form	Minimum Order Quantity
AOD2544	TO-252	Tape & Reel	2500

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	23	A
	T_C=100°C		16	
Pulsed Drain Current [C]		I_{DM}	45	
Continuous Drain Current	T_A=25°C	I_{DSM}	6.5	A
	T_A=70°C		5.0	
Avalanche Current [C]		I_{AS}	15	A
Avalanche energy L=0.3mH [C]		E_{AS}	34	mJ
V_{DS} Spike	10µs	V_{SPIKE}	180	V
Power Dissipation [B]	T_C=25°C	P_D	75	W
	T_C=100°C		37.5	
Power Dissipation [A]	T_A=25°C	P_{DSM}	6.2	W
	T_A=70°C		4.0	
Junction and Storage Temperature Range		T_J, T_{STG}	-55 to 175	°C

Thermal Characteristics

Parameter		Symbol	Typ	Max	Units
Maximum Junction-to-Ambient [A]	t ≤ 10s	$R_{\theta JA}$	15	20	°C/W
Maximum Junction-to-Ambient [A D]	Steady-State		40	50	°C/W
Maximum Junction-to-Case	Steady-State	$R_{\theta JC}$	1.6	2.0	°C/W

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, V_{GS}=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	1.7	2.15	2.7	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=10V, I_D=5A		45	54	mΩ
		T_J=125°C		89	107	
		V_{GS}=4.5V, I_D=2A		52.5	66	mΩ
g_{FS}	Forward Transconductance	V_{DS}=5V, I_D=5A		17		S
V_{SD}	Diode Forward Voltage	I_S=1A,V_{GS}=0V		0.72	1	V
I_S	Maximum Body-Diode Continuous Current				23	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=75V, f=1MHz		675		pF
C_{oss}	Output Capacitance			78		pF
C_{rss}	Reverse Transfer Capacitance			4		pF
R_g	Gate resistance	f=1MHz	1.4	2.9	4.4	Ω
SWITCHING PARAMETERS						
Q_g(10V)	Total Gate Charge	V_{GS}=10V, V_{DS}=75V, I_D=5A		11.5	20	nC
Q_g(4.5V)	Total Gate Charge			5.5	10	nC
Q_{gs}	Gate Source Charge			2		nC
Q_{gd}	Gate Drain Charge			2.5		nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=10V, V_{DS}=75V, R_L=15Ω, R_{GEN}=3Ω		6		ns
t_r	Turn-On Rise Time			3		ns
$t_{D(off)}$	Turn-Off DelayTime			20		ns
t_f	Turn-Off Fall Time			5		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=5A, dI/dt=500A/µs		37		ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=5A, dI/dt=500A/µs		210		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 175° C may be used if the PCB allows it.
B. The power dissipation P_D is based on $T_{J(MAX)}$=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. Single pulse width limited by junction temperature $T_{J(MAX)}$=175° 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 $T_{J(MAX)}$=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 in² FR-4 board with 2oz. Copper, in a still air environment with T_A=25° C.

THIS PRODUCT HAS BEEN DESIGNED AND QUALIFIED FOR THE CONSUMER MARKET. APPLICATIONS OR USES AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS ARE NOT AUTHORIZED. AOS DOES NOT ASSUME ANY LIABILITY ARISING OUT OF SUCH APPLICATIONS OR USES OF ITS PRODUCTS. AOS RESERVES THE RIGHT TO IMPROVE PRODUCT DESIGN, FUNCTIONS AND RELIABILITY WITHOUT NOTICE.

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

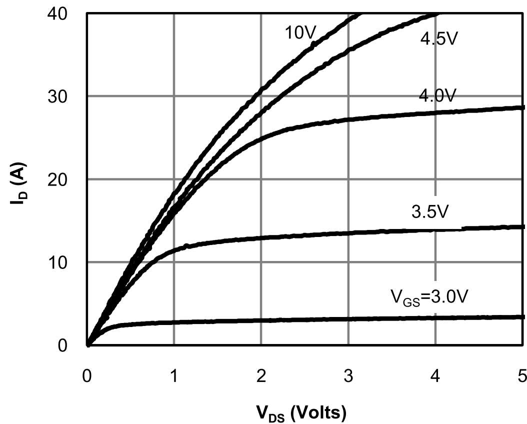


Figure 1: On-Region Characteristics (Note E)

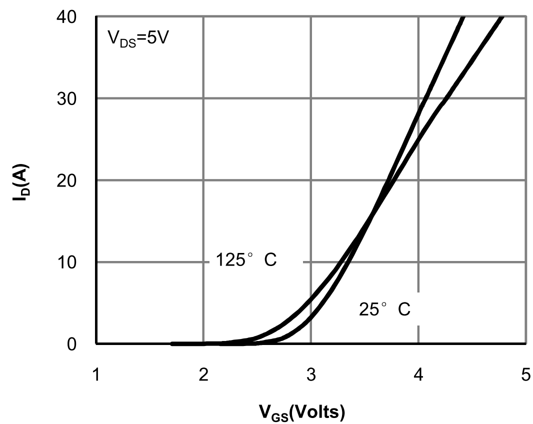


Figure 2: Transfer Characteristics (Note E)

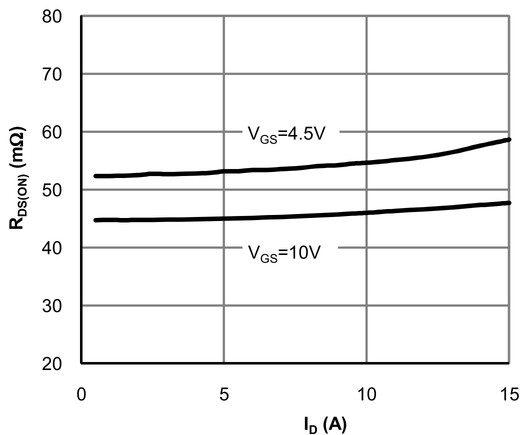


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

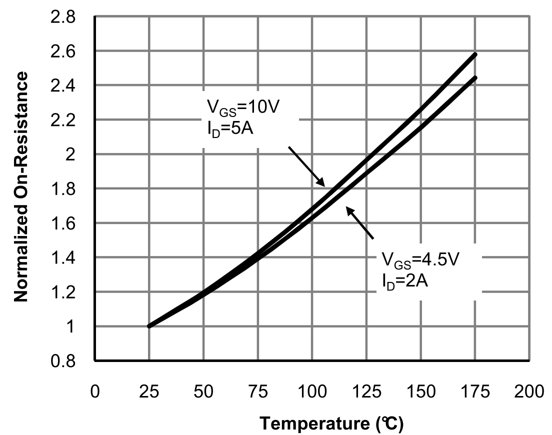


Figure 4: On-Resistance vs. Junction Temperature (Note E)

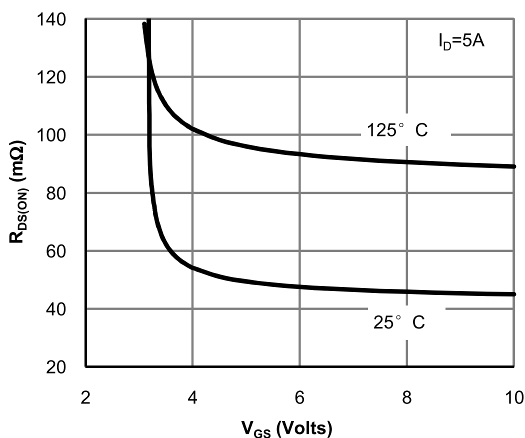


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

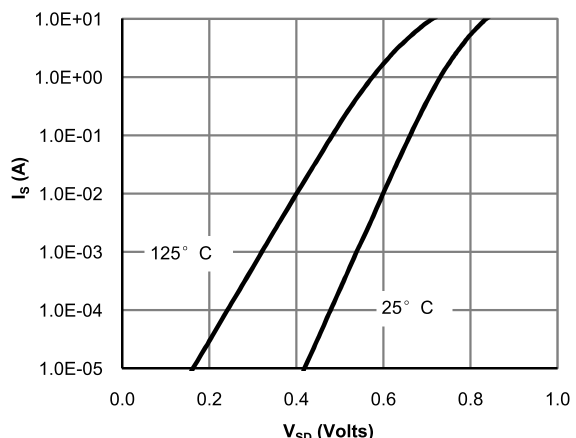


Figure 6: Body-Diode Characteristics (Note E)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

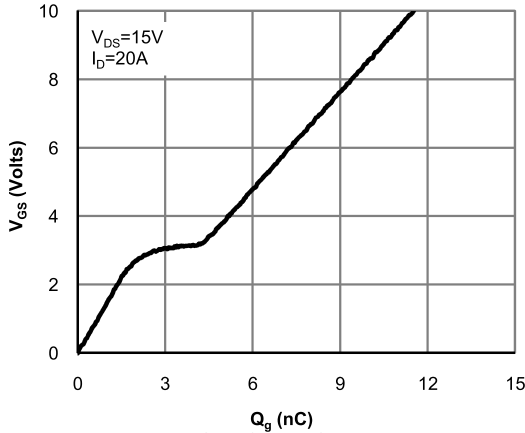


Figure 7: Gate-Charge Characteristics

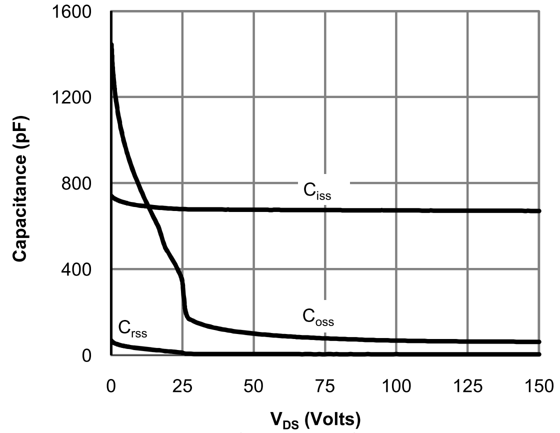
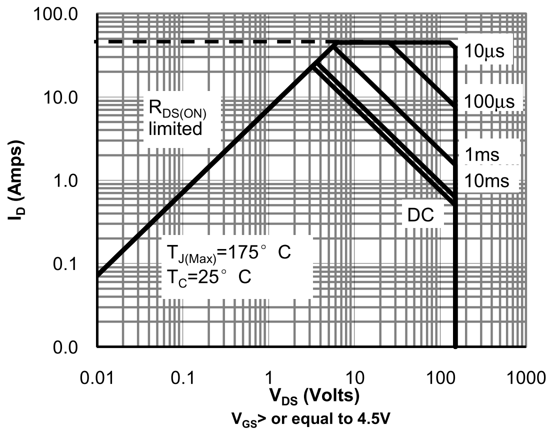


Figure 8: Capacitance Characteristics



V_{GS}> or equal to 4.5V

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

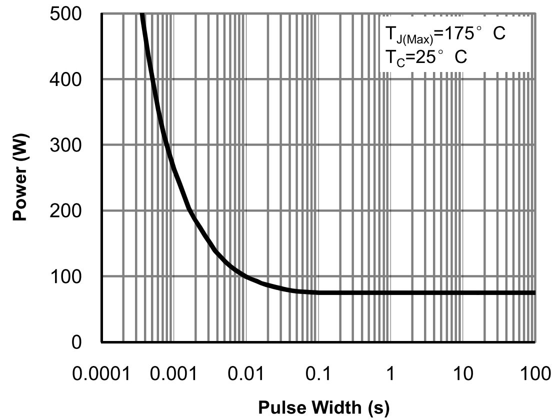


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

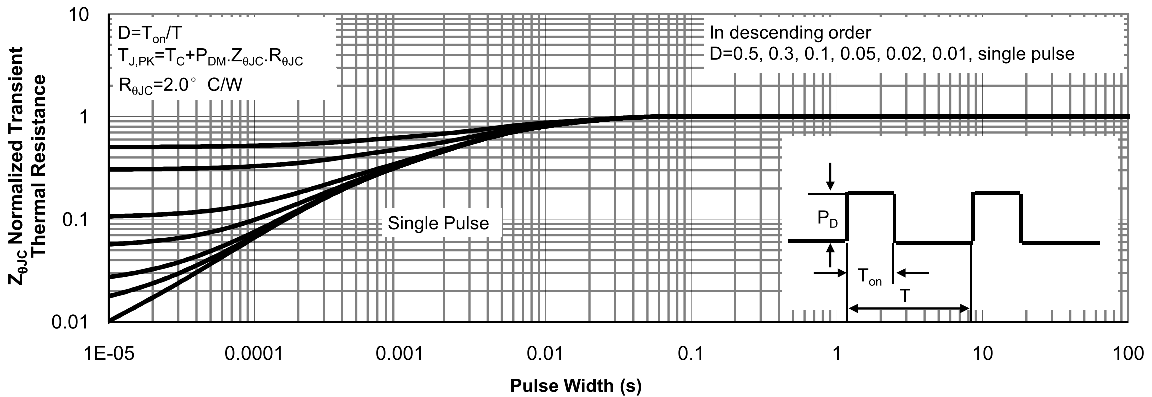


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

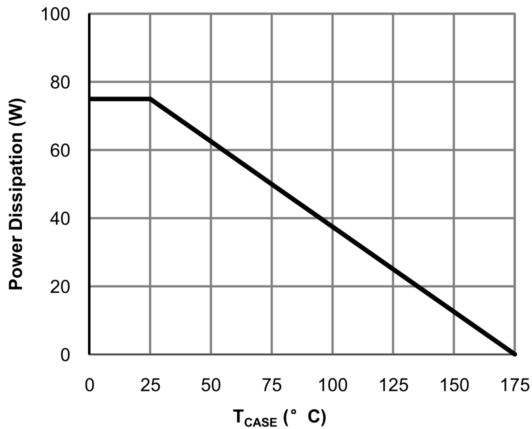


Figure 12: Power De-rating (Note F)

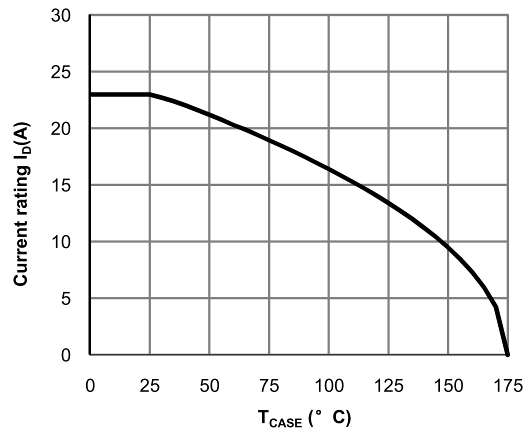


Figure 13: Current De-rating (Note F)

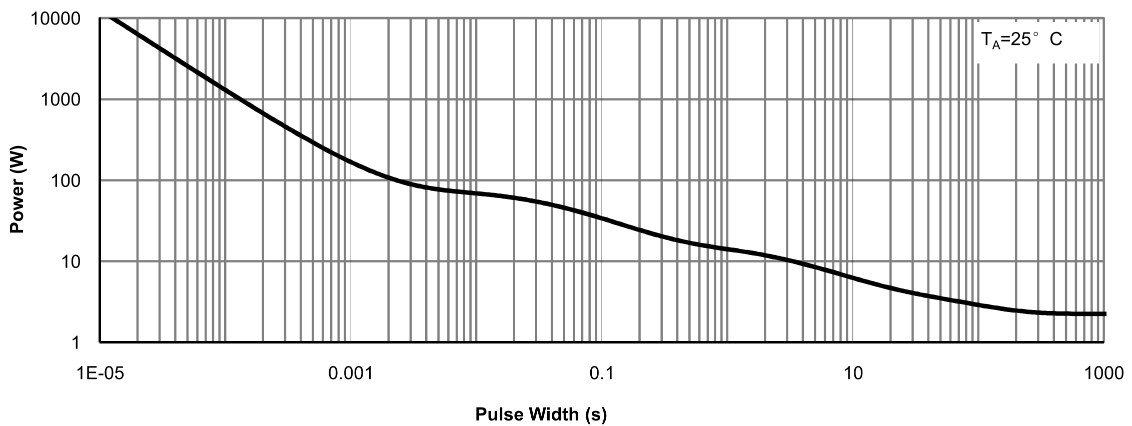


Figure 14: Single Pulse Power Rating Junction-to-Ambient (Note H)

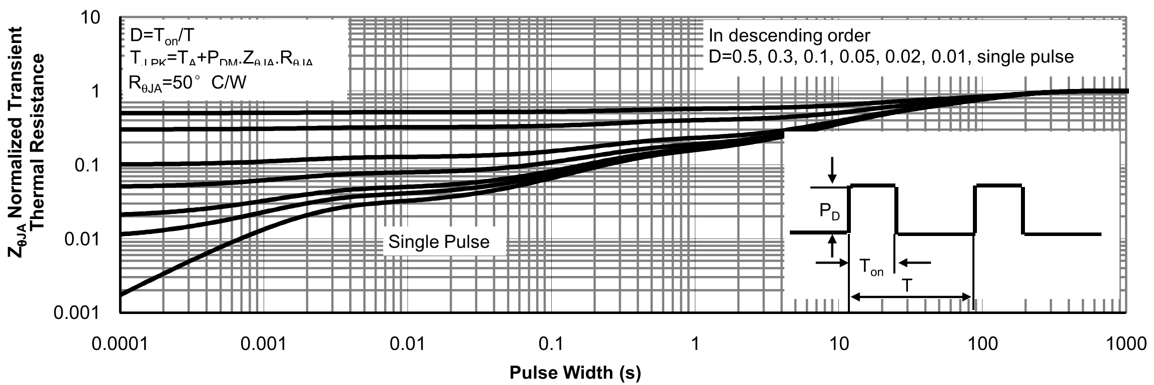


Figure 15: Normalized Maximum Transient Thermal Impedance (Note H)

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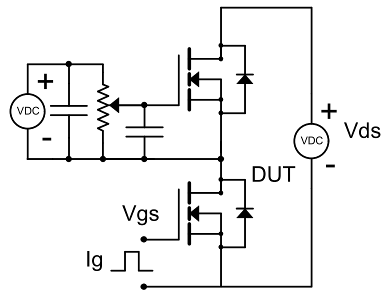
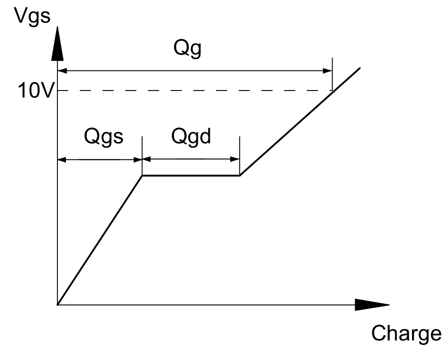
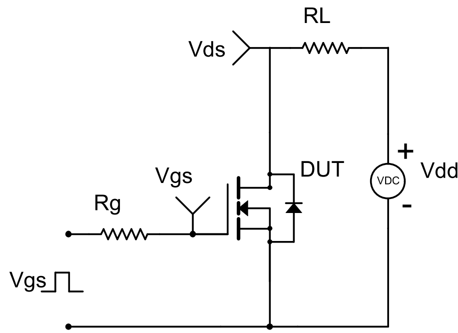
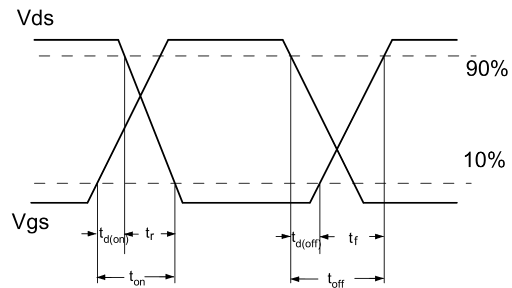
Gate Charge Test Circuit & Waveform



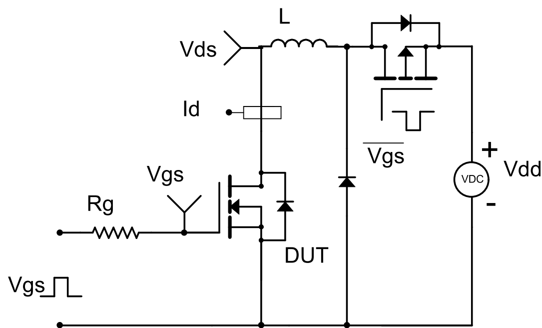


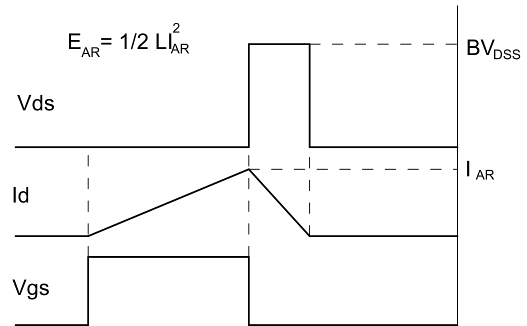
Resistive Switching Test Circuit & Waveforms



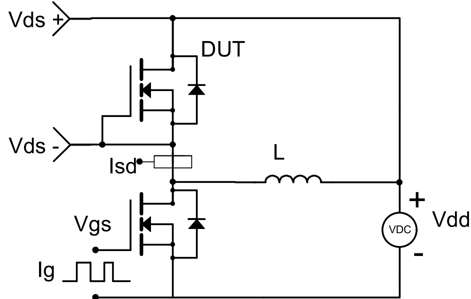


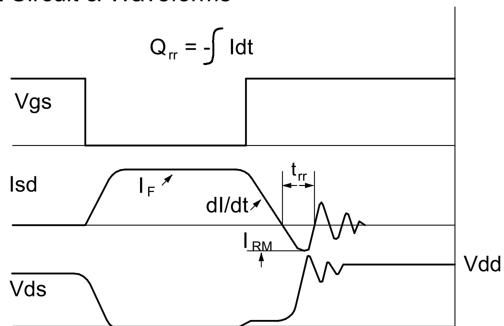
Unclamped Inductive Switching (UIS) Test Circuit & Waveforms





Diode Recovery Test Circuit & Waveforms





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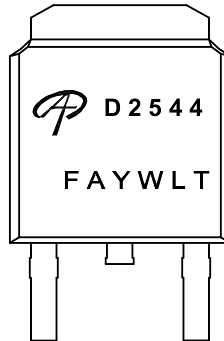
Document No.	PD-02124
Version	A
Title	AOD2544 Marking Description

TO252(DPAK) PACKAGE MARKING DESCRIPTION



Green product

NOTE:
LOGO - AOS Logo
D2544 - 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
AOD2544	Green product	D2544
AOD2544L	Green product	D2544

Material Content Data Sheet

Issue Date: 2014/3/3
Product Type: Power MOSFET
Package Type: TO252 (DPAK)

Weight: 320 mg

Construction Element	Material Group	Materials	CAS if applicable	Weight (mg)	Content (%)	Weight (mg)	Average Mass (%)	Sum (%)	Trace
Chip	inorganic material	Silicon	7440-21-3	7.20	100.00%	7.2	2.25%	2.25%	
Lead Frame	non noble metal	Copper	7440-50-8	160.85	99.70%	160.3675	50.11%	50.27%	
	non noble metal	Tin	7440-31-5		0.30%	0.48255	0.15%		
Die attach material	non noble metal	Lead	7439-92-1	5.00	93.50%	4.675	1.46%	1.56%	
	non noble metal	Tin	7440-31-5		5.00%	0.25	0.08%		
	noble metal	Silver	7440-22-4		1.50%	0.075	0.02%		
Bonding wire	noble metal	Gold	7440-57-5	0.70	100.00%	0.7	0.22%	0.22%	
	non noble metal	Aluminum	7429-90-5						
Encapsulation	organic material	Silica fused	60676-86-0	140.25	66.50%	93.26625	29.15%	43.83%	
	organic material	Epoxy, Cresol Novolac	29690-82-2		15.00%	21.0375	6.57%		
	organic material	Phenol nonolac	9003-35-4		8.00%	11.22	3.51%		
	organic material	Metal Hydroxide	Trade Secret		10.00%	14.025	4.38%		
	organic material	Carbon black	1333-86-4		0.50%	0.70125	0.22%		
Lead Finished	non noble metal	Tin	7440-31-5	6.00	100.00%	6	1.88%	1.88%	
		Sum in Total						100.00%	

* Deviation <25%

Important Remarks:

1. All statements are based on our present knowledge and are subject to change at any time due to technical requirements and developments

Note: The above data is prepared based on APM BOM "BM-00009Y"

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Recommended Temperature Profile For Soldering AOS Product with Lead Free Solder

For AOS internal reliability precondition profile see Appendix A

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TITLE: Soldering Temperature Profile of AOS Product with Lead free solder

1 PURPOSE

This document defines the recommendation of soldering temperature profiles for all the Alpha & Omega Semiconductor (AOS) products. Using temperature and time duration not to exceed these conditions will prevent damage to the parts during the mounting processes, and also help to ensure the quality and reliability of AOS parts.

2 SCOPE

This procedure is applicable to all of AOS product/packages that are required to perform soldering on to PCB (Printed circuit board)

3 REFERENCE DOCUMENTS

JESD22-A113，Preconditioning of Nonhermetic Surface Mount Devices Prior to Reliability Testing
IPC/JEDEC J-STD-020D，Moisture/Reflow Sensitivity Classification for Nonhermetic Solid State Surface Mount Devices

4 GENERAL

Soldering profile is used in PCB assembly. Since different system, different components and different solder are used by different customer, the optimum soldering condition to insure the solder integrity and reliability can only be determined by user (customer). AOS does not assume any responsibilities for the recommendation outlined in this document.

However during the reliability qualification, AOS parts are subject to very severe condition in accordance with the IPC/JEDEC J-STD-20D document (see profile in Appendix A), which involves one week moisture absorption in 85 ºC and 85% relative humidity follow by three solder reflows simulation for 30 sec at peak temperature between 255 ºC and 260 ºC. By using temperature and time duration not to exceed these recommended conditions will be obviously not damage AOS parts.

5 Recommended Soldering Profile

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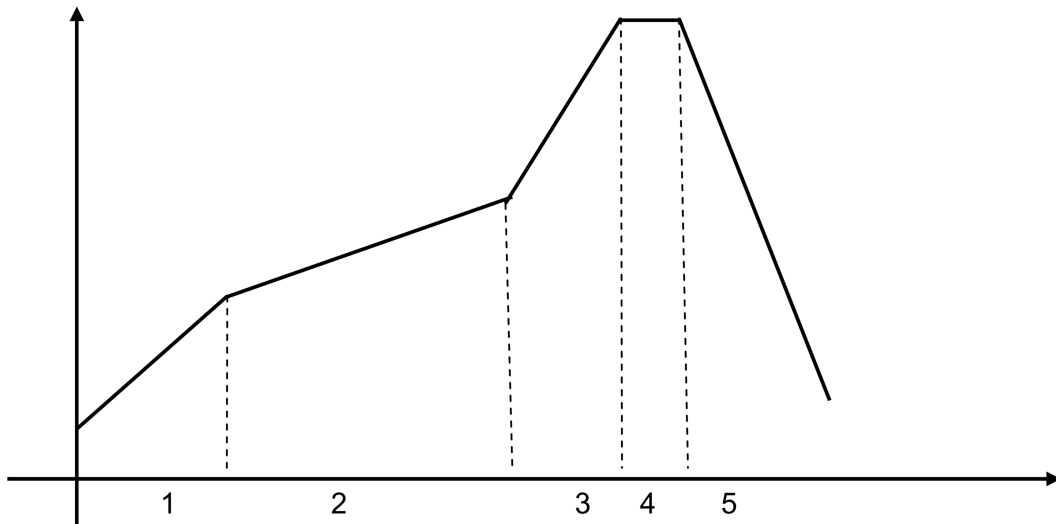
5.1 Reflow Soldering Profile:



Profile Feature	Requirement
1. Ramp up	1-4 ºC/second
2. Soak	150 ºC~200 ºC 60-180 seconds
3. Ramp up	1-4ºC/second
4. Peak soak *	245~260 ºC 10 seconds max
5. Ramp-down Rate	1~6 ºC/second max.

* Maximum thermal excursion allowed during the reflow assembly is as follow:

Temperature: 255 ºC ~ 260 ºC

Duration at peak soak: 30 sec

Number of reflow: 3

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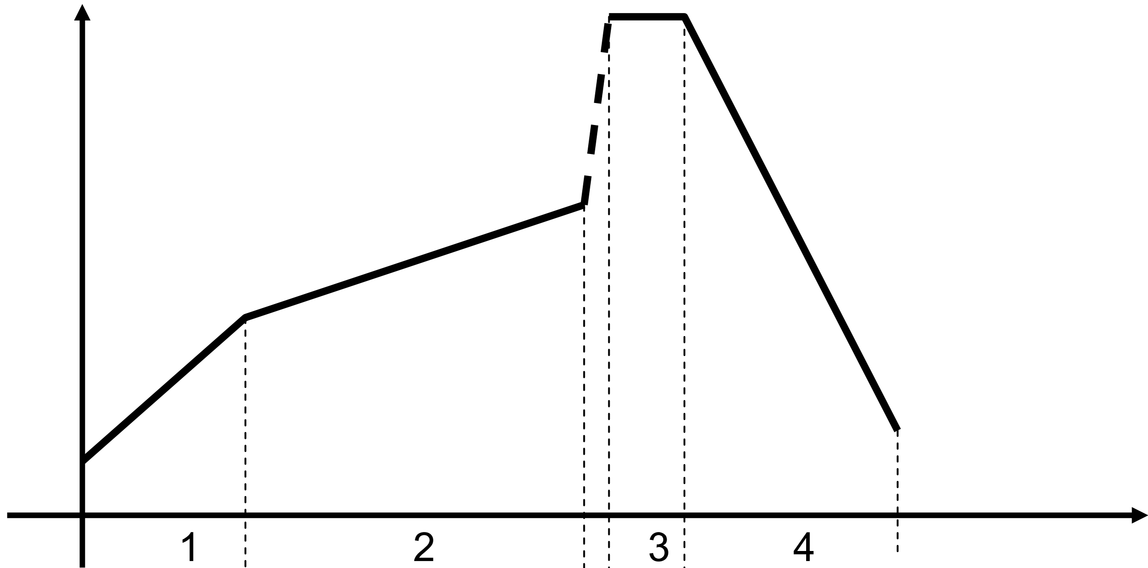
5.2 Wave Soldering Profile:

Not recommended for leadless package



Profile Feature	Recommended Condition
1. Preheat - Ramp up rate	1-7 ºC/second
2. Soak - Temprature: - Time:	80ºC ramp to 140ºC 60-120 seconds
3. Peak - Peak package body temperature - Time	245 ºC to 260 ºC 10 seconds max.
4. Ramp down: - Ramp down rate:	1-7 ºC/second

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5.3 Hand Soldering:

Not recommended for mass production. For engineering project or re-work should be used with cautious

Parameters	**Recommended Condition**
Tip Temperature	350 ±10 ºC
Time*	3 seconds

*Maximum duration is 5 seconds

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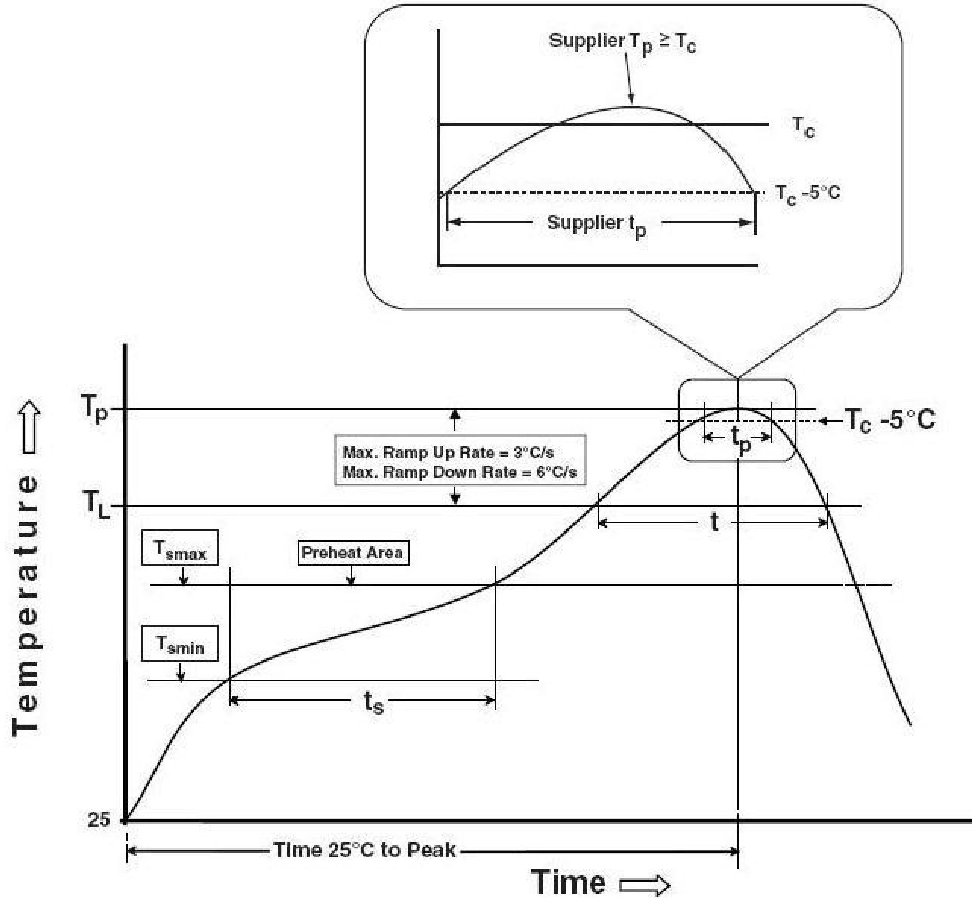
Appendix A

AOS internal reflow profile for reliability test precondition is as follow:



Profile Feature	Condition
Preheat & Soak - Temperature Min ($T_{S(min)}$): - Temperature Max ($T_{S(min)}$): - Time (min to max)(ts):	 150 ºC 200 ºC 60-120 seconds
Average ramp-up rate (T_{smax} to T_p)	3 ºC/second max
Liquidous Temperature (T_L): Time (t_L):	217 ºC 60-150 seconds
Peak Package body Temperature(T_p)*: See IPC/JEDEC J-STD-020 for detail	Tp must equal to or exceed the Classification Temperature. Typically Tp = 260 ºC
Time t_p within 5ºC of specified classification temperature (T_C):	30 seconds min.
Ramp-down Rate (T_p to T_{smax}) :	6 ºC/second max.
Time 25 ºC to Peak Temp. :	8 minutes max

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