AONU32320

30V Dual N-Channel MOSFET

General Description

- Trench Power MOSFET technology
- Low $R_{D1D2(ON)}$
- Logic Level Driving
- Pb-Free lead Plating, RoHS and Halogen-Free Compliant

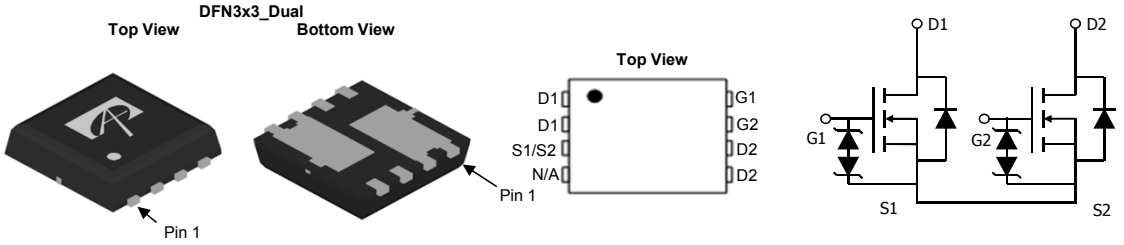
Applications

- USB PD Load switch

Product Summary

V_{DS}	30V
I_D (at V_{GS}=10V)	15A
$R_{D1D2(ON)}$ (at V_{GS}=10V)	< 13mΩ
$R_{D1D2(ON)}$ (at V_{GS}=4.5V)	< 18.5mΩ
Typical ESD protection	**HBM Class 1C**

100% UIS Tested
100% Rg Tested



Orderable Part Number	Package Type	Form	Minimum Order Quantity
AONU32320	DFN 3x3 EP	Tape & Reel	5000

Absolute Maximum Ratings T_A=25°C unless otherwise noted

Parameter		Symbol	Maximum	Units
Drain-Source Voltage		V_{DS}	30	V
Gate-Source Voltage		V_{GS}	±20	V
Continuous Drain Current[G]	T_C=25°C	I_D	15	A
	T_C=100°C		15	
Pulsed Drain Current [C]		I_{DM}	56	
Continuous Drain Current	T_A=25°C	I_{DSM}	15	A
	T_A=70°C		12	
Avalanche Current [C]		I_{AS}	20	A
Avalanche energy	L=0.1mH [C]	E_{AS}	33	mJ
Power Dissipation [B]	T_C=25°C	P_D	16.5	W
	T_C=100°C		6.5	
Power Dissipation [A]	T_A=25°C	P_{DSM}	5	W
	T_A=70°C		3.2	
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	$R_{\theta JA}$	20	25	°C/W
Maximum Junction-to-Ambient [A D]	Steady-State		45	55	°C/W
Maximum Junction-to-Case	Steady-State	$R_{\theta JC}$	6	7.5	°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	30			V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=30V, V_{GS}=0V			1	µA
		T_J=55°C			5	
I_{GSS}	Gate-Body leakage current	V_{DS}=0V, V_{GS}=±20V			±10	µA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS}, I_D=250µA	1.3	1.8	2.3	V
$R_{D1D2(ON)}$	Static Drain-Source On-Resistance	V_{GS}=10V, I_D=11A		10.8	13	mΩ
		T_J=125°C		16.7	20	
		V_{GS}=4.5V, I_D=7A		14.5	18.5	mΩ
g_{FS}	Forward Transconductance	V_{DS}=5V, I_D=11A		38		S
V_{SD}	Diode Forward Voltage	I_S=1A, V_{GS}=0V		0.7	1	V
I_S	Maximum Body-Diode Continuous Current [G]				15	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=15V, f=1MHz		1500		pF
C_{oss}	Output Capacitance			160		pF
C_{rss}	Reverse Transfer Capacitance			130		pF
R_g	Gate resistance	f=1MHz	1	2	3	Ω
SWITCHING PARAMETERS						
Q_g(10V)	Total Gate Charge	V_{GS}=10V, V_{DS}=15V, I_D=11A		28	40	nC
Q_g(4.5V)	Total Gate Charge			13	22	nC
Q_{gs}	Gate Source Charge			3.5		nC
Q_{gd}	Gate Drain Charge			5.5		nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=10V, V_{DS}=15V, R_L=1.35Ω, R_{GEN}=3Ω		6		ns
t_r	Turn-On Rise Time			10		ns
$t_{D(off)}$	Turn-Off DelayTime			30		ns
t_f	Turn-Off Fall Time			6.5		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=11A, di/dt=500A/µs		7		ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=11A, di/dt=500A/µs		10		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.
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

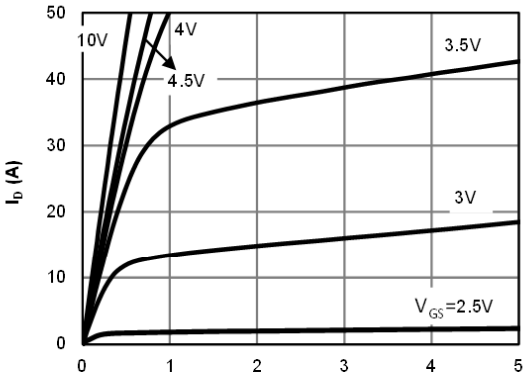


Figure 1: On-Region Characteristics (Note E)

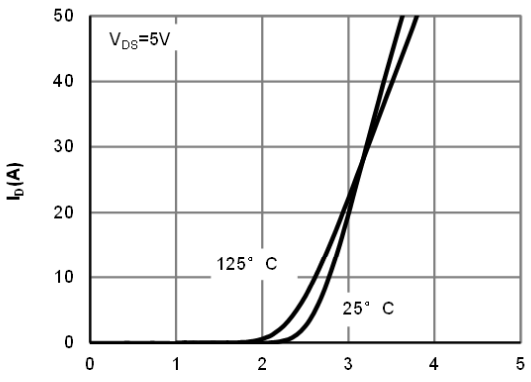


Figure 2: Transfer Characteristics (Note E)

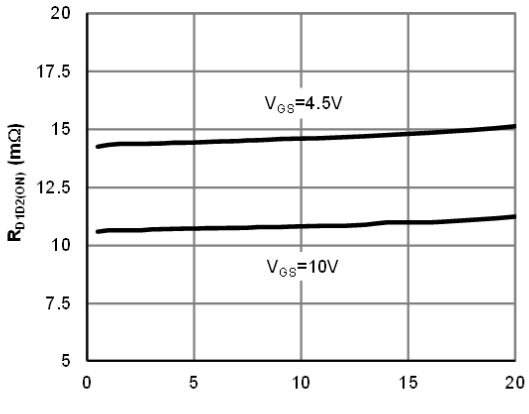


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

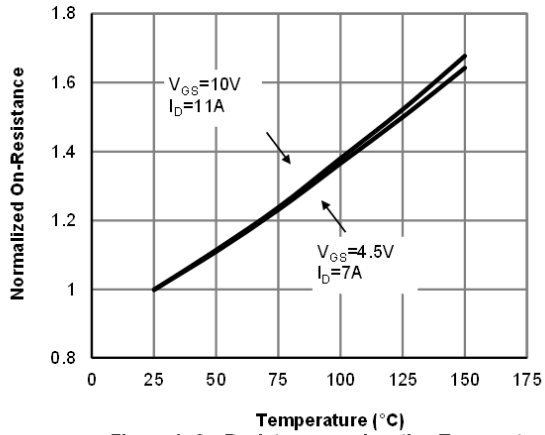


Figure 4: On-Resistance vs. Junction Temperature (Note E)

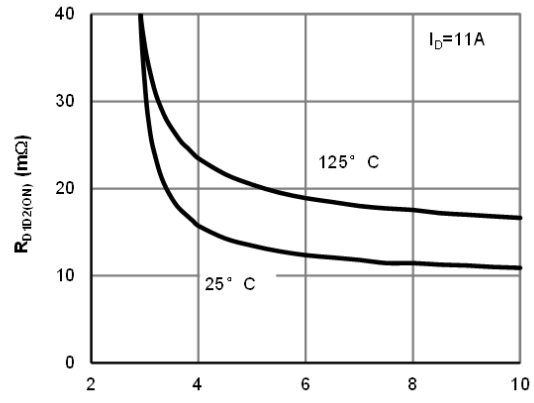


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

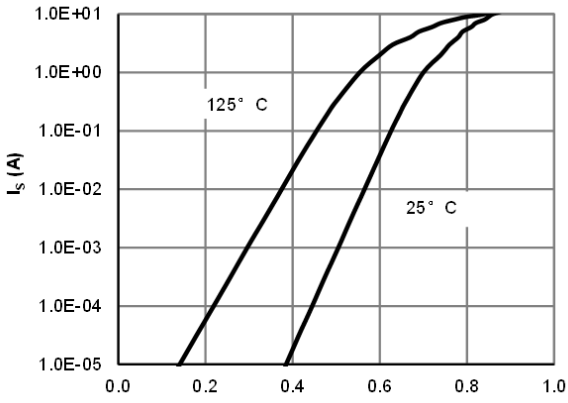


Figure 6: Body-Diode Characteristics (Note E)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

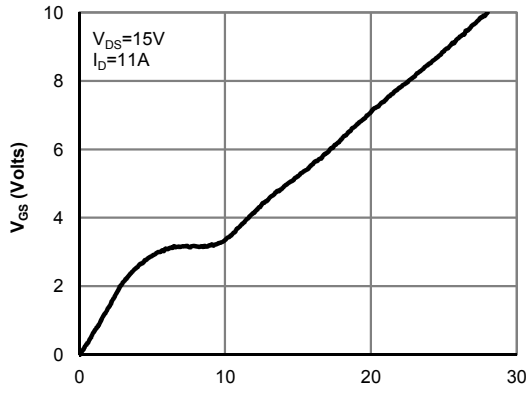


Figure 7: Gate-Charge Characteristics

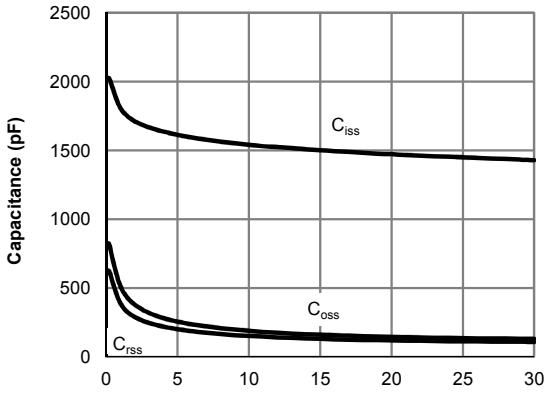


Figure 8: Capacitance Characteristics

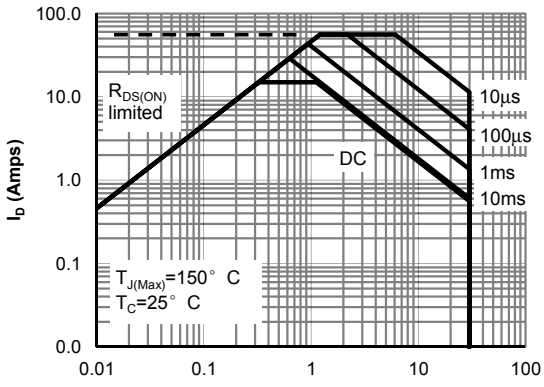


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

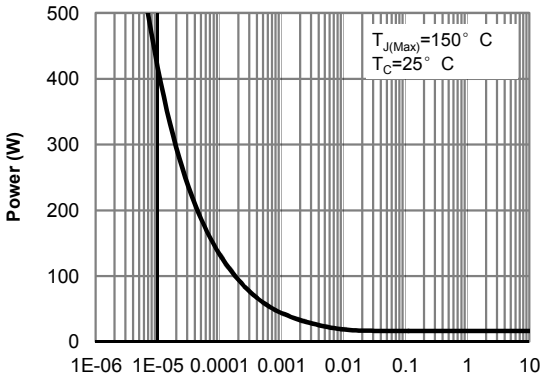


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

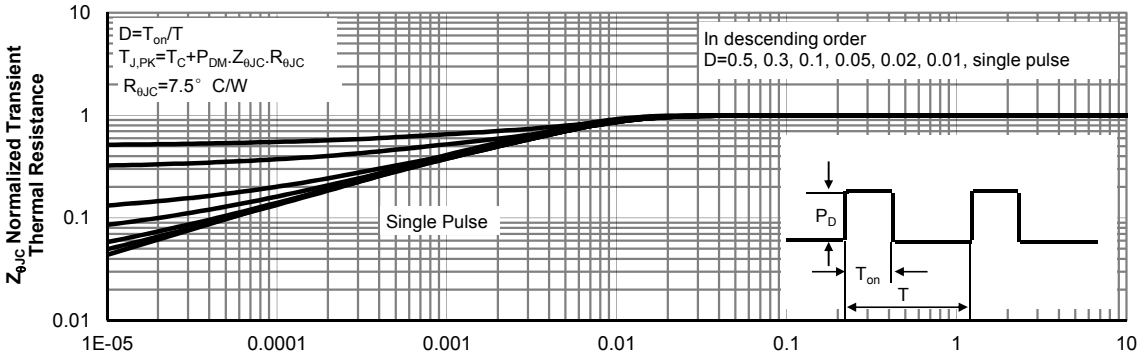


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

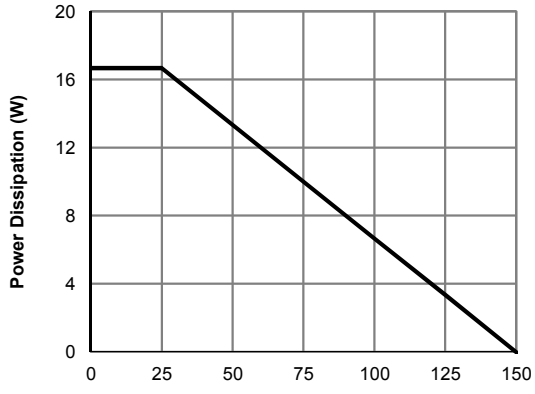


Figure 12: Power De-rating (Note F)

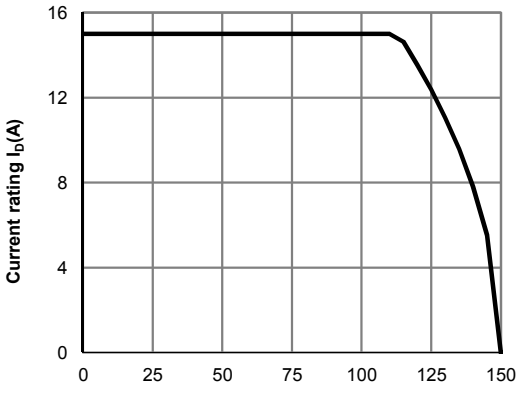


Figure 13: Current De-rating (Note F)

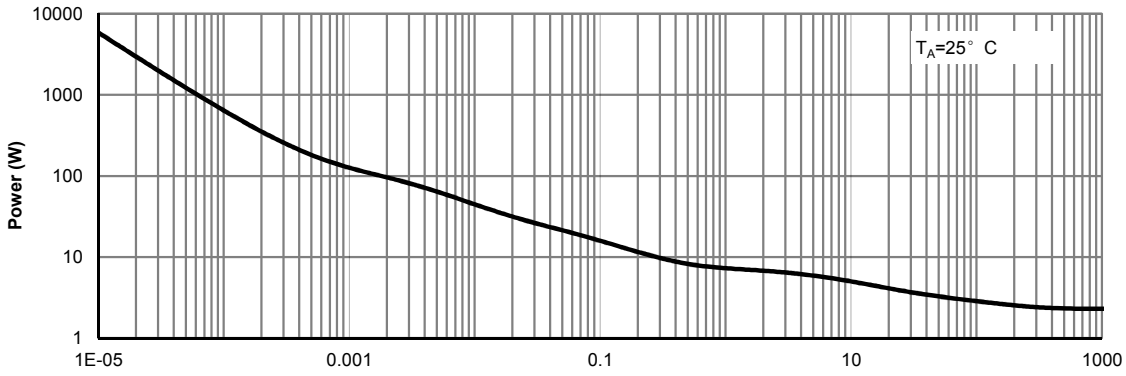


Figure 14: Single Pulse Power Rating Junction-to-Ambient (Note H)

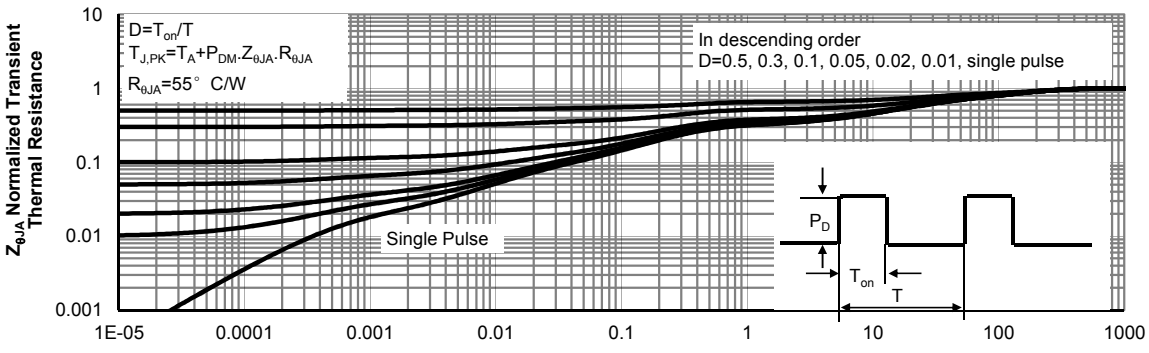
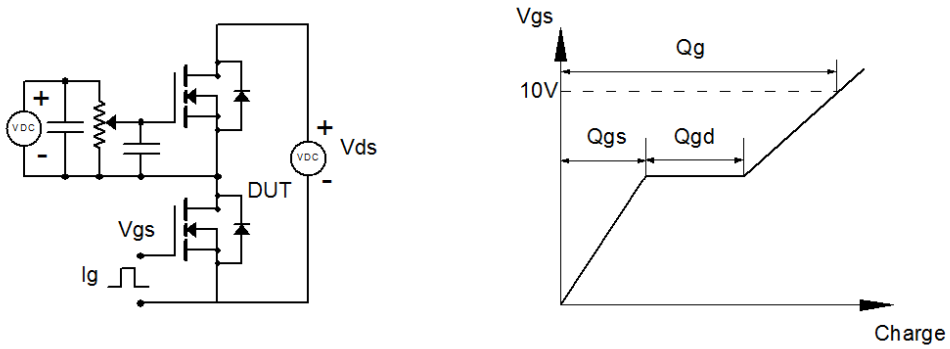
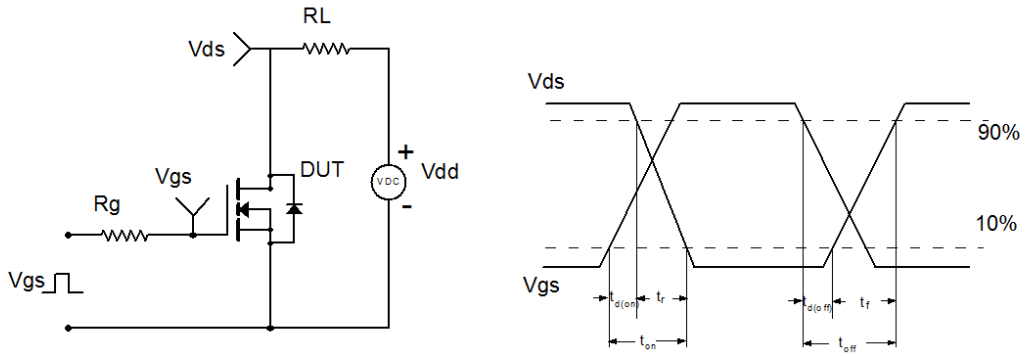


Figure 15: Normalized Maximum Transient Thermal Impedance (Note H)

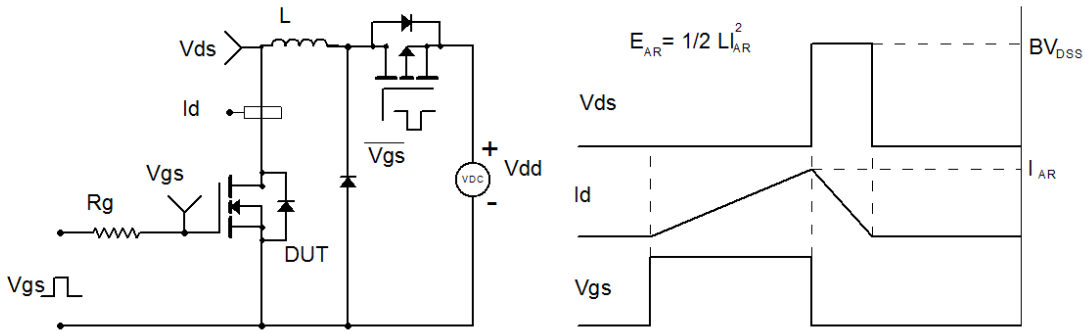
Gate Charge Test Circuit & Waveform



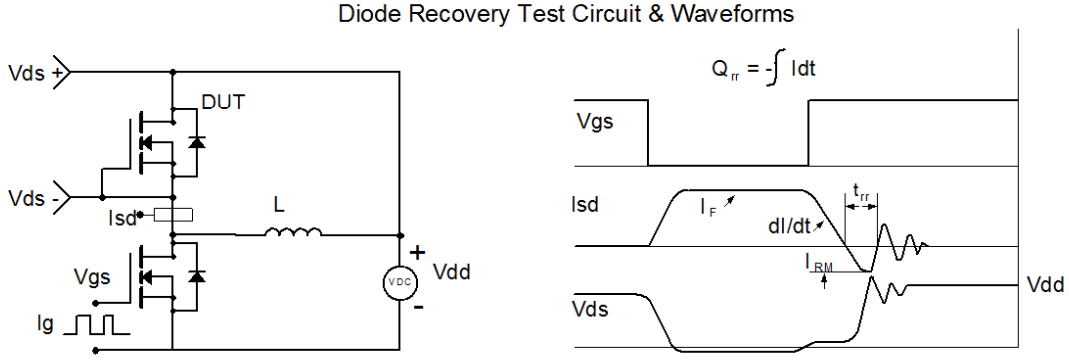
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



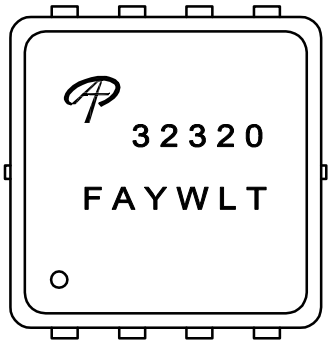
Diode Recovery Test Circuit & Waveforms



ALPHA & OMEGA SEMICONDUCTOR

Document No.	PD-02947
Version	A
Title	AONU32320 Marking Description

DFN3x3 PACKAGE MARKING DESCRIPTION



Green product

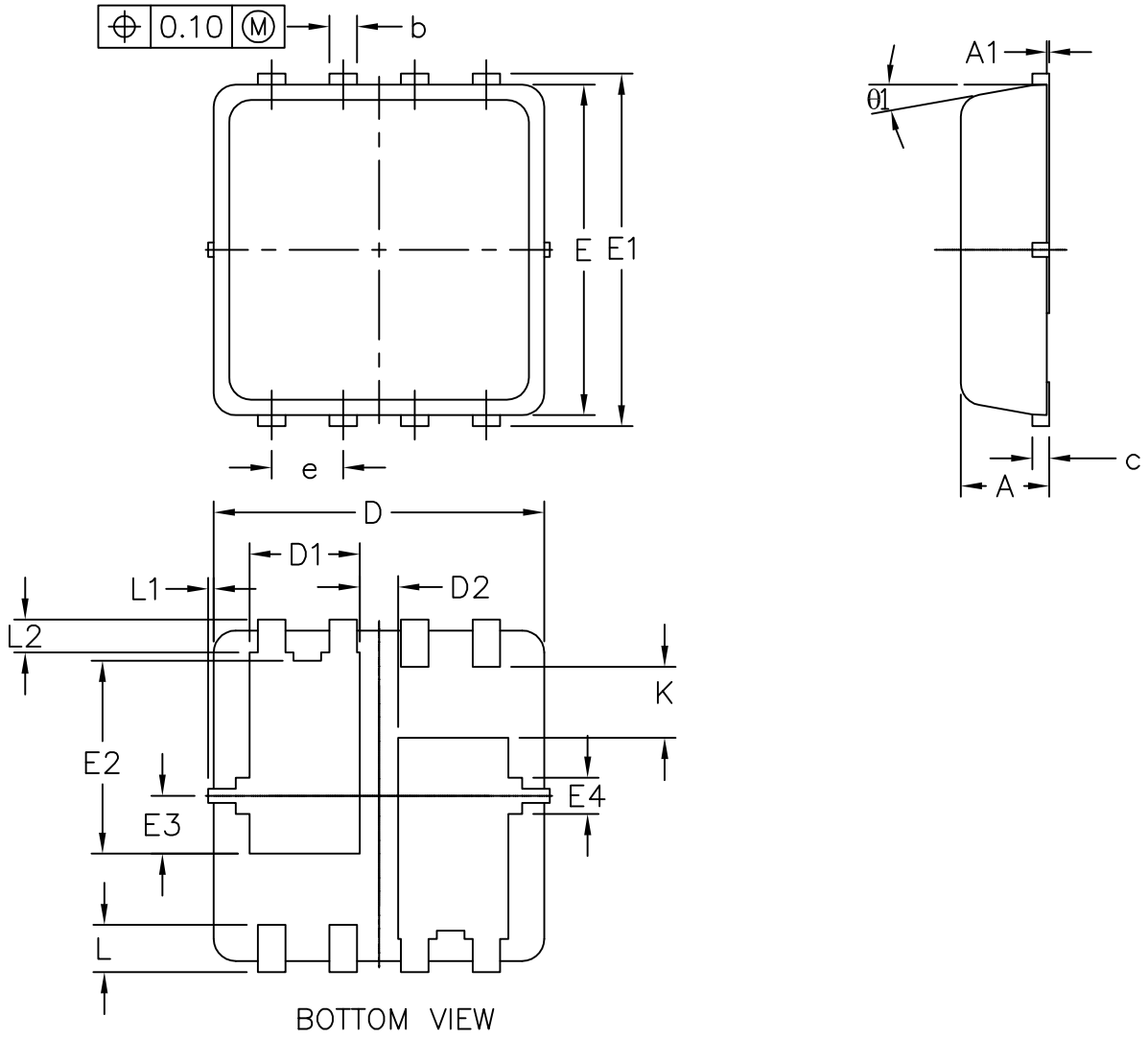
NOTE:
LOGO - AOS Logo
32320 - Part number code
F - Fab code
A - Assembly location code
Y - Year code
W - Week code
L&T - Assembly lot code

PART NO.	DESCRIPTION	CODE
AONU32320	Green product	32320

ALPHA & OMEGA SEMICONDUCTOR

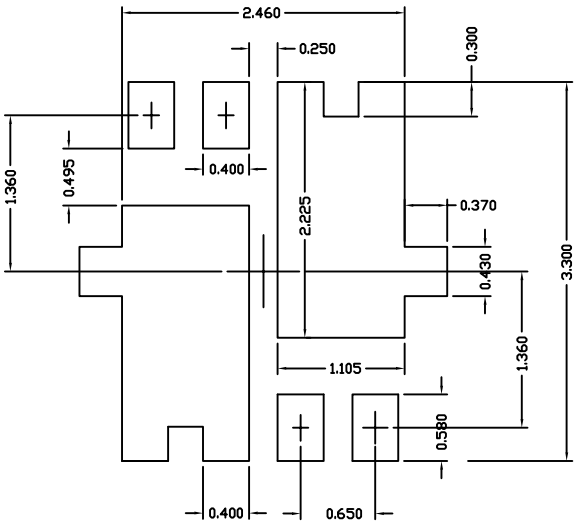
Document No.	PO-00128
Version	B

DFN3x3_8L_EP2_P PACKAGE OUTLINE



BOTTOM VIEW

RECOMMENDED LAND PATTERN



UNIT: mm

SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.70	0.80	0.90	0.028	0.031	0.035
A1	0.00	---	0.05	0.000	---	0.002
b	0.24	0.25	0.30	0.009	0.010	0.012
c	0.10	0.15	0.25	0.004	0.006	0.010
D	2.90	3.00	3.10	0.114	0.118	0.122
D1	0.85	1.00	1.15	0.033	0.039	0.045
D2	0.25	0.35	0.45	0.010	0.014	0.018
E	2.90	3.00	3.10	0.114	0.118	0.122
E1	3.05	3.20	3.35	0.120	0.126	0.132
E2	1.55	1.75	1.95	0.061	0.069	0.077
E3	0.43	0.53	0.63	0.017	0.021	0.025
E4	0.28	0.33	0.38	0.011	0.013	0.015
e	0.60	0.65	0.70	0.024	0.026	0.028
K	0.45	0.65	0.85	0.018	0.026	0.033
L	0.33	0.43	0.53	0.013	0.017	0.021
L1	0	---	0.10	0	---	0.004
L2	0.25	0.30	0.35	0.010	0.012	0.014
θ1	0°	10°	12°	0°	10°	12°

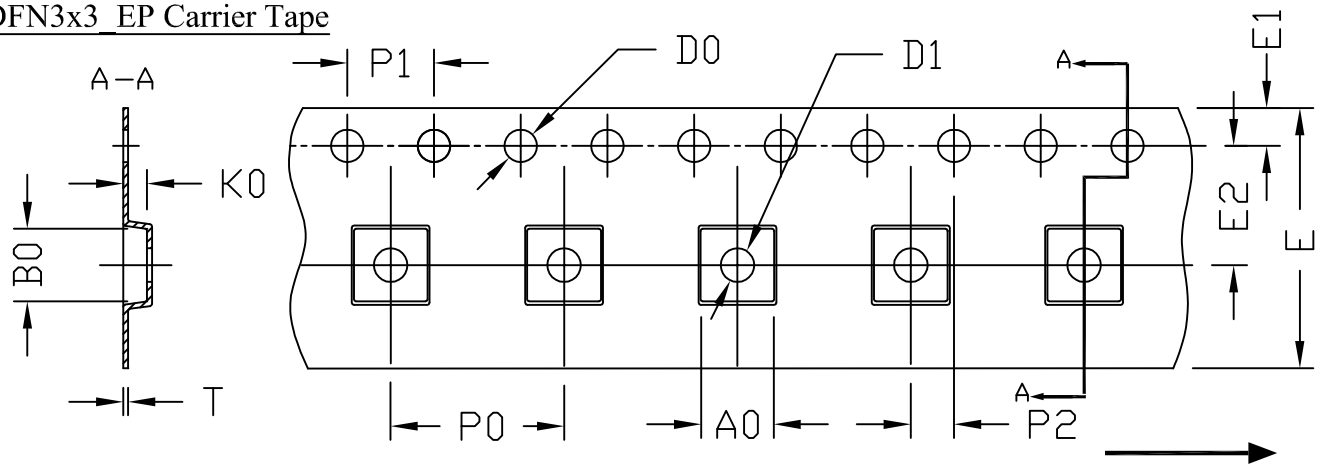
NOTE

1. PAKCAGE BODY SIZES EXCLUDE MOLD FLASH AND GATE BURRS.
   MOLD FLASH AT THE NON-LEAD SIDES SHOULD BE LESS THAN 6 MILS EACH.
2. CONTROLLING DIMENSION IS MILLIMETER.
   CONVERTED INCH DIMENSIONS ARE NOT NECESSARILY EXACT.

ALPHA & OMEGA
SEMICONDUCTOR, LTD.

DFN3x3_EP Tape and Reel Data

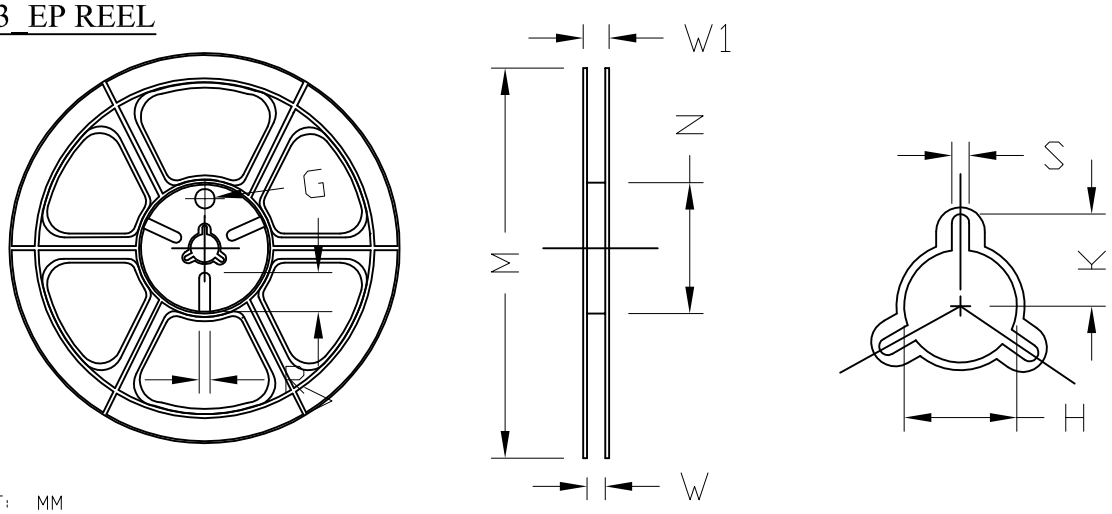
DFN3x3_EP Carrier Tape



UNIT: MM

PACKAGE	A0	B0	K0	D0	D1	E	E1	E2	P0	P1	P2	T
DFN3x3_EP	3.40 ±0.10	3.35 ±0.10	1.10 ±0.10	1.50 +0.10 −0	1.50 +0.10 −0	12.00 ±0.30	1.75 ±0.10	5.50 ±0.05	8.00 ±0.10	4.00 ±0.10	2.00 ±0.05	0.30 ±0.05

DFN3x3_EP REEL



UNIT: MM

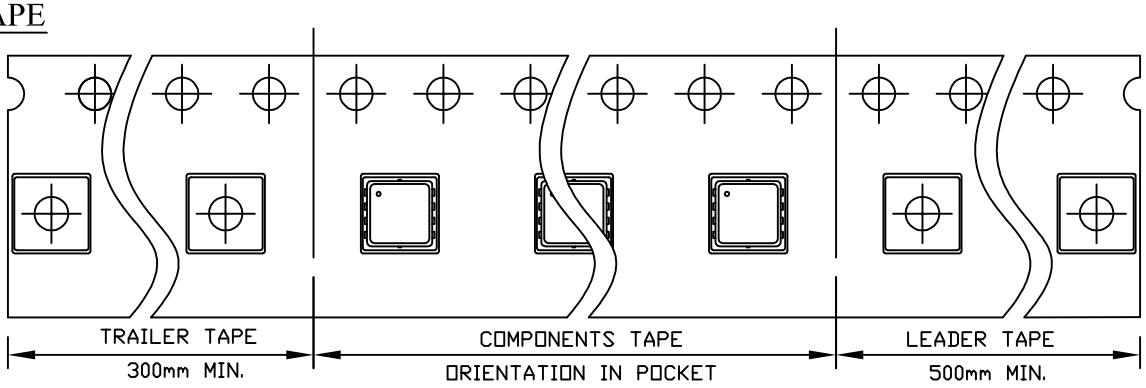
TAPE SIZE	REEL SIZE	M	N	W	W1	H	K	S	G	R	V
12 mm	ø330	ø330.00 ±0.50	ø97.00 ±0.10	13.00 ±0.30	17.40 ±1.00	ø13.00 +0.50 −0.20	10.60	2.00 ±0.50	---	---	---

DFN3x3_EP TAPE

Leader / Trailer
& Orientation

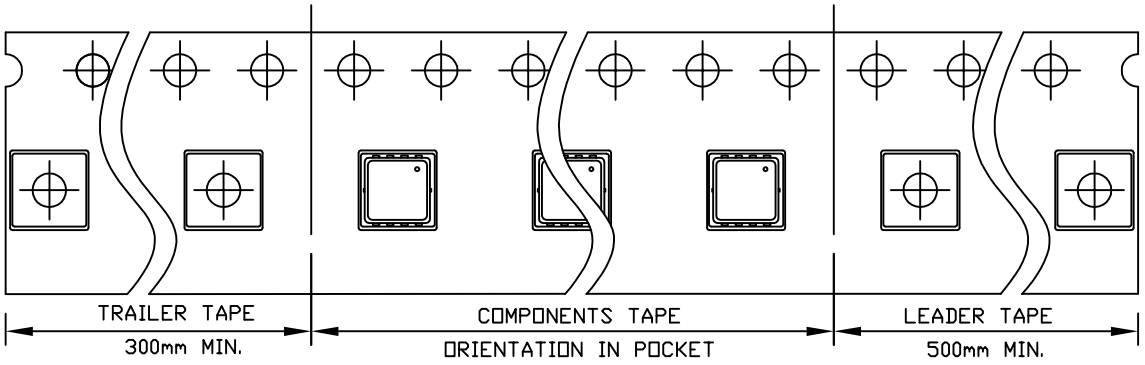
MOS

Unit Per Reel:
5000pcs



PIC

Unit Per Reel:
5000pcs



AOS Semiconductor
Product Reliability Report

AONU32320, rev A

Plastic Encapsulated Device

ALPHA & OMEGA Semiconductor, Inc

www.aosmd.com

Jan, 2019

ALPHA & OMEGA SEMICONDUCTOR

This AOS product reliability report summarizes the qualification result for AONU32320. 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 AONU32320 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.

I. 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	462 pcs	0	JESD22-A108
HTRB	Temp = 150°C , Vds=100% of Vdsmax	168 / 500 / 1000 hours	462 pcs	0	JESD22-A108
Precondition (Note A)	168hr 85°C / 85%RH + 3 cycle reflow@260°C (MSL 1)	-	4620 pcs	0	JESD22-A113
HAST	130°C , 85%RH, 33.3 psia, Vds = 80% of Vdsmax	96 hours	693 pcs	0	JESD22-A110
H3TRB	85°C , 85%RH, Vds = 80% of Vdsmax	1000 hours	693 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,	1000cycles	924 pcs	0	JESD22-A104
HTSL	Temp = 150°C	1000 hours	693 pcs	0	JESD22-A103
IOL	Δ Tj = 100°C	15000 cycles	693 pcs	0	MIL-STD-750 Method 1037

Note: The reliability data presents total of available generic data up to the published date.
Note A: MSL (Moisture Sensitivity Level) 1 based on J-STD-020

II. Reliability Evaluation

FIT rate (per billion): 3.82
MTTF = 29919 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)**] =** 3.82
MTTF = 10^9 / FIT = 29919 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