



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

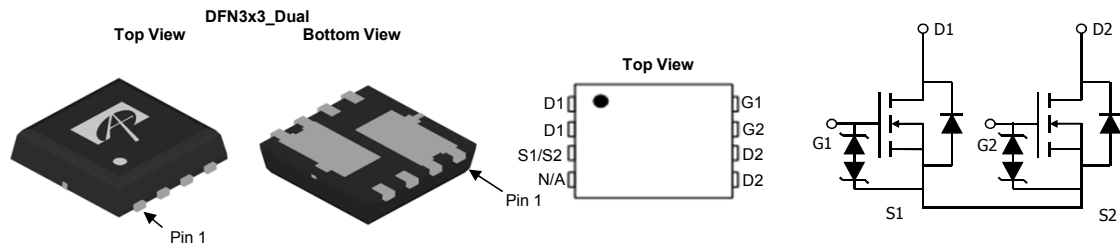
Product Summary

V_{DS}	30V
I_D (at $V_{GS}=10V$)	15A
$R_{D1D2(ON)}$ (at $V_{GS}=10V$)	< 13m Ω
$R_{D1D2(ON)}$ (at $V_{GS}=4.5V$)	< 18.5m Ω

Typical ESD protection

100% UIS Tested
100% Rg Tested

HBM Class 1C



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

Absolute Maximum Ratings $T_A=25^\circ\text{C}$ 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	I_D	15	A
$T_C=25^\circ\text{C}$		15	
$T_C=100^\circ\text{C}$			
Pulsed Drain Current ^C	I_{DM}	56	
Continuous Drain Current	I_{DSM}	15	A
$T_A=25^\circ\text{C}$		12	
$T_A=70^\circ\text{C}$			
Avalanche Current ^C	I_{AS}	20	A
Avalanche energy $L=0.1\text{mH}$ ^C	E_{AS}	33	mJ
Power Dissipation ^B	P_D	16.5	W
$T_C=25^\circ\text{C}$		6.5	
$T_C=100^\circ\text{C}$			
Power Dissipation ^A	P_{DSM}	5	W
$T_A=25^\circ\text{C}$		3.2	
$T_A=70^\circ\text{C}$			
Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 150	$^\circ\text{C}$

Thermal Characteristics

Parameter	Symbol	Typ	Max	Units
Maximum Junction-to-Ambient ^A	$R_{\theta JA}$	20	25	$^\circ\text{C/W}$
$t \leq 10\text{s}$				
Maximum Junction-to-Ambient ^{A,B}	$R_{\theta JA}$	45	55	$^\circ\text{C/W}$
Steady-State				
Maximum Junction-to-Case	$R_{\theta JC}$	6	7.5	$^\circ\text{C/W}$
Steady-State				

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 T _J =55°C			1 5	μA
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 T _J =125°C		10.8 16.7	13 20	mΩ
		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 ⁶				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_{θJA} 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_{θJA} 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_{θJA} is the sum of the thermal impedance from junction to case R_{θJC} 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.

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

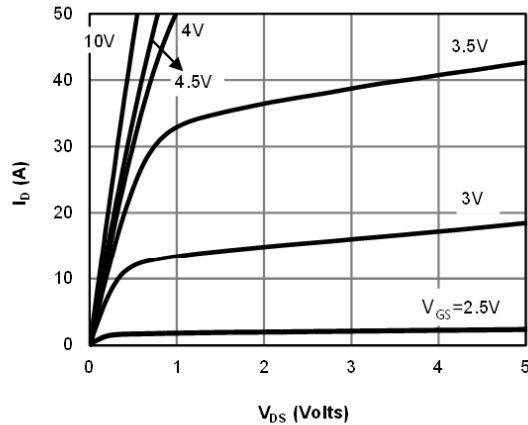


Figure 1: On-Region Characteristics (Note E)

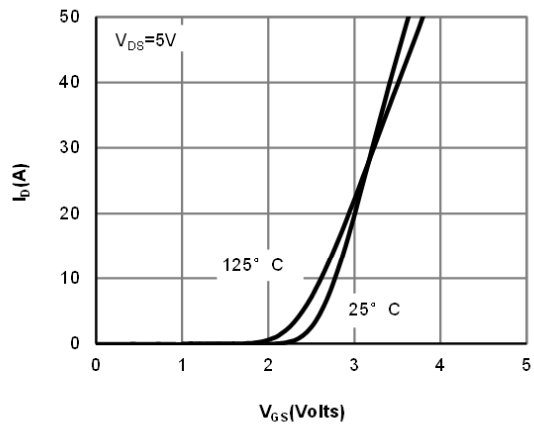


Figure 2: Transfer Characteristics (Note E)

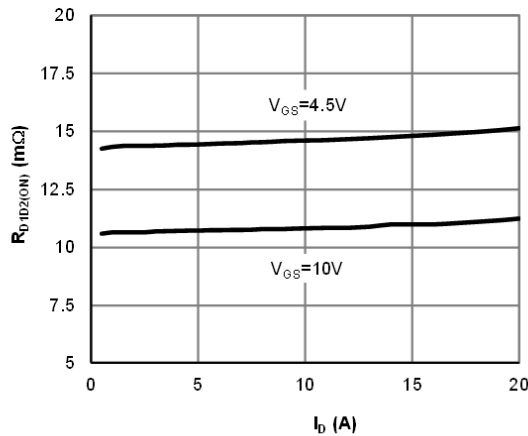


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

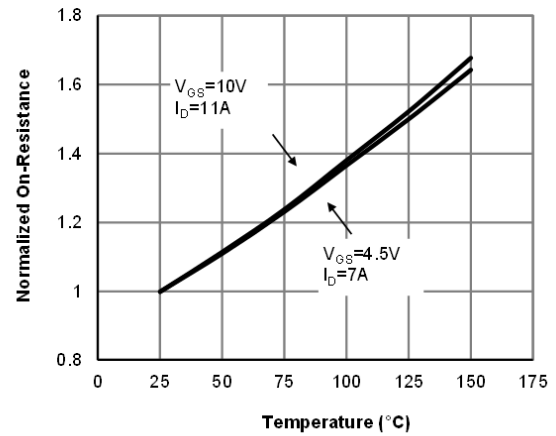


Figure 4: On-Resistance vs. Junction Temperature (Note E)

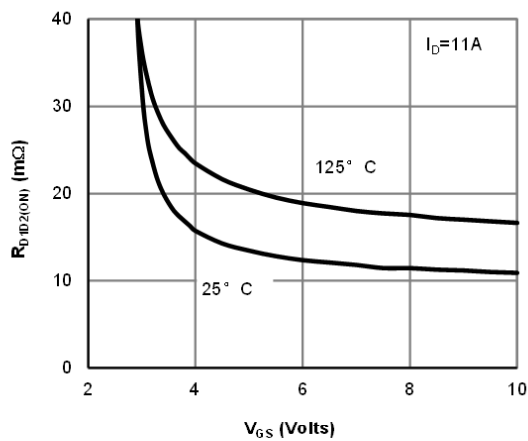


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

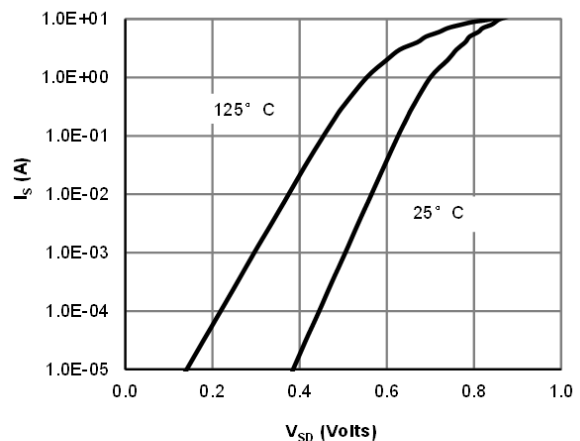
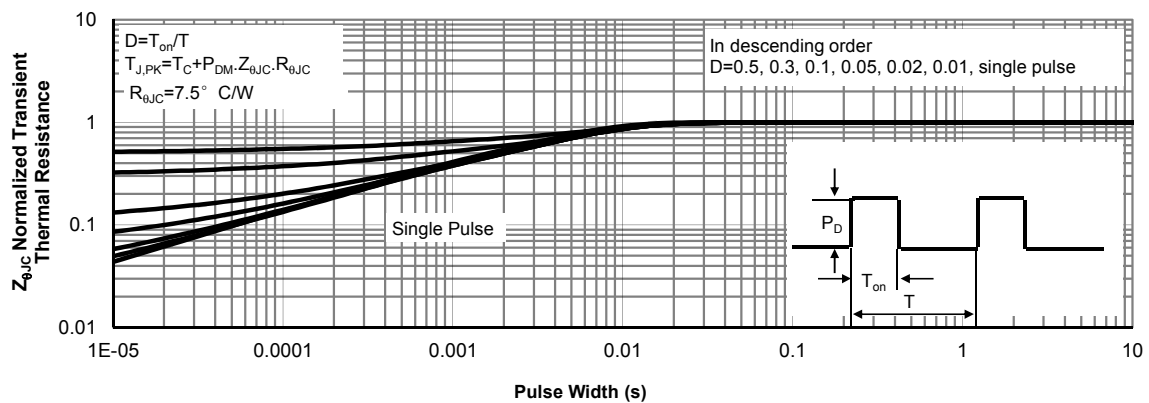
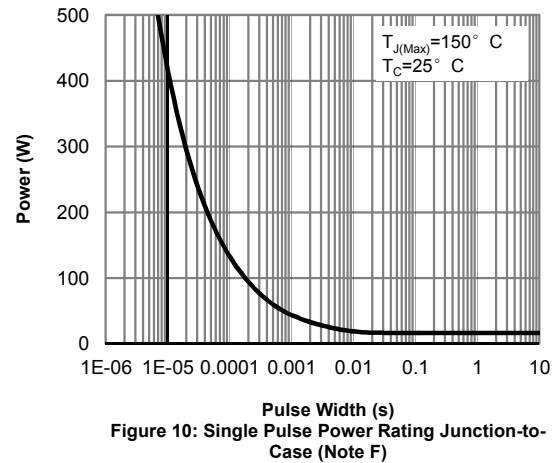
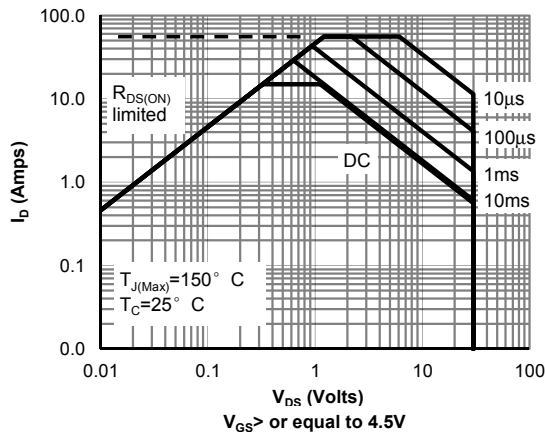
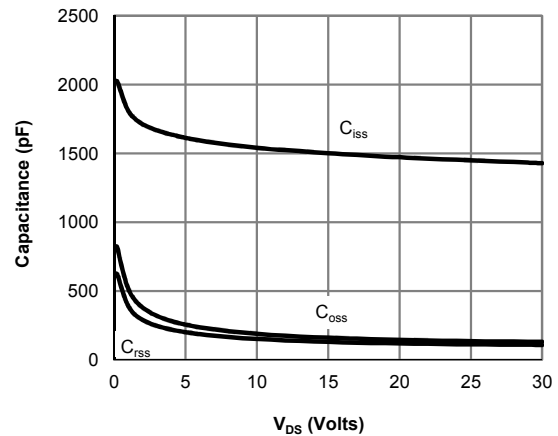
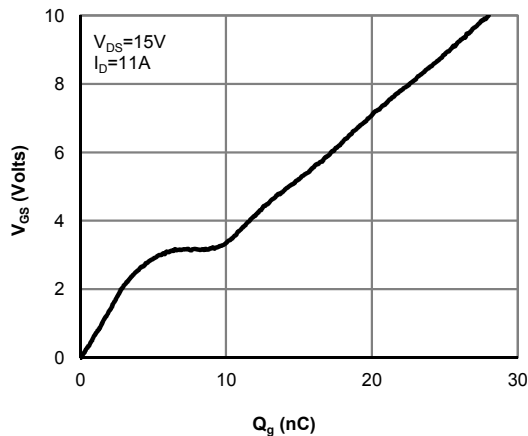


Figure 6: Body-Diode Characteristics (Note E)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS



TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

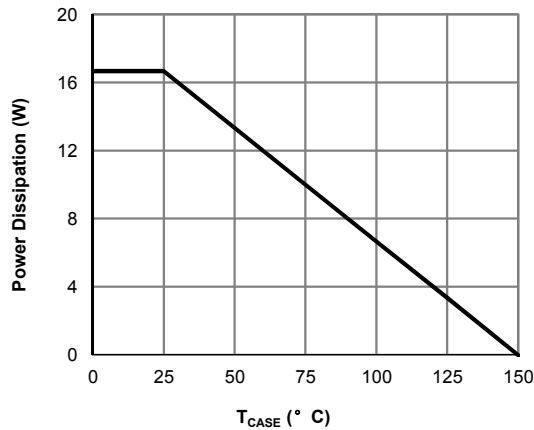


Figure 12: Power De-rating (Note F)

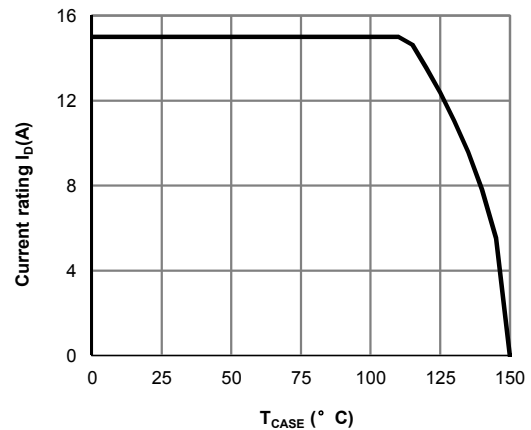


Figure 13: Current De-rating (Note F)

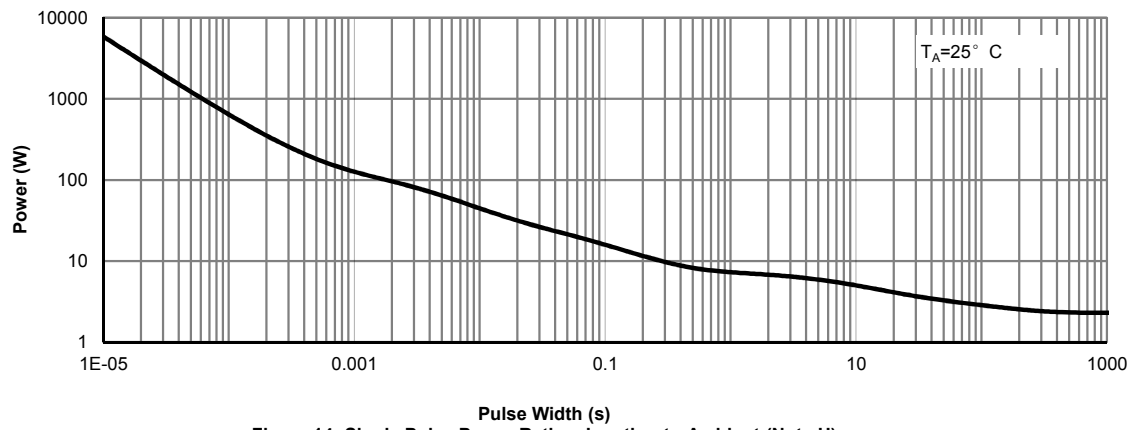


Figure 14: Single Pulse Power Rating Junction-to-Ambient (Note H)

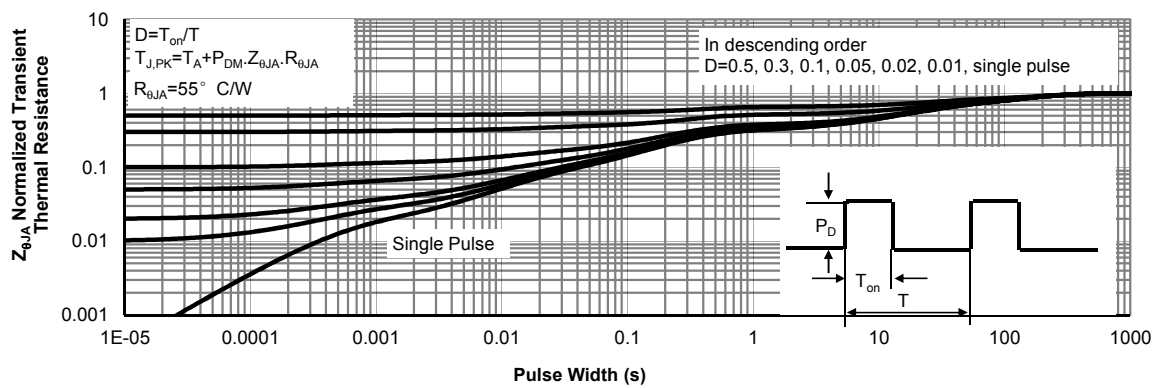
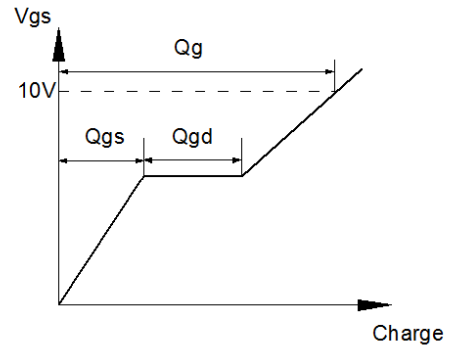
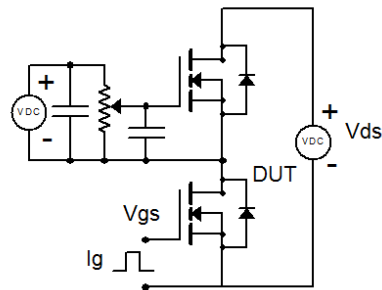
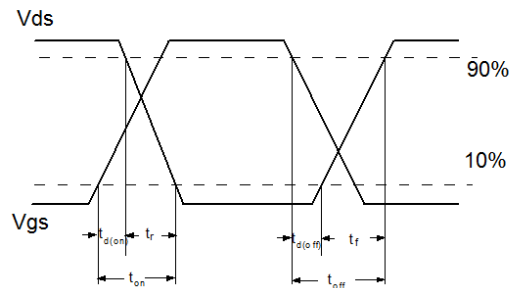
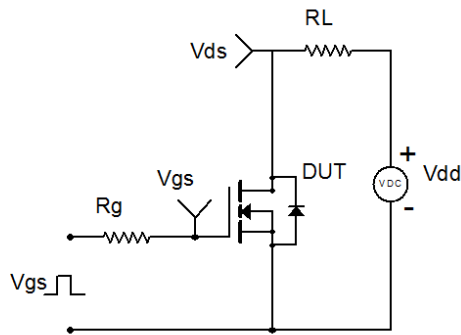


Figure 15: Normalized Maximum Transient Thermal Impedance (Note H)

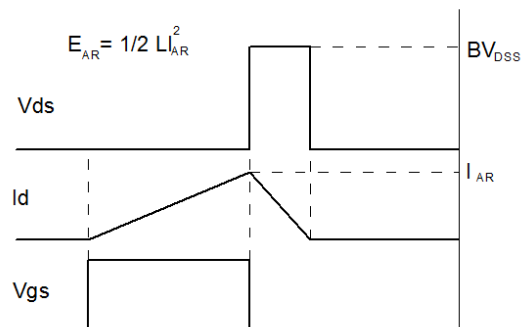
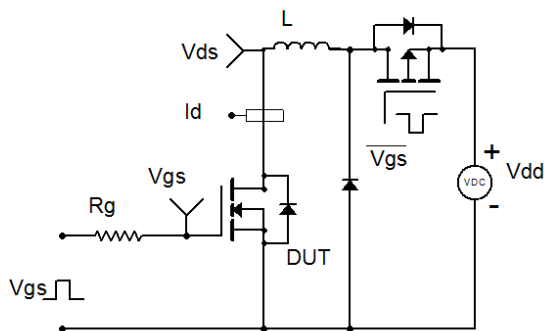
Gate Charge Test Circuit & Waveform



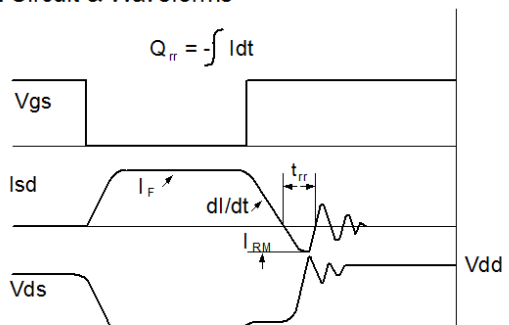
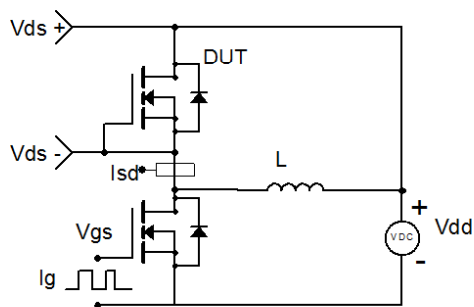
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

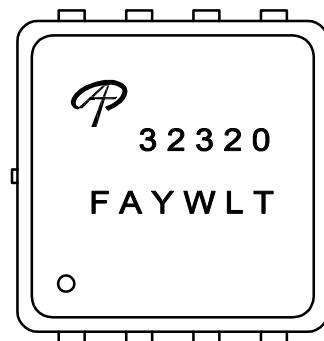


Diode Recovery Test Circuit & Waveforms





DFN3x3 PACKAGE MARKING DESCRIPTION

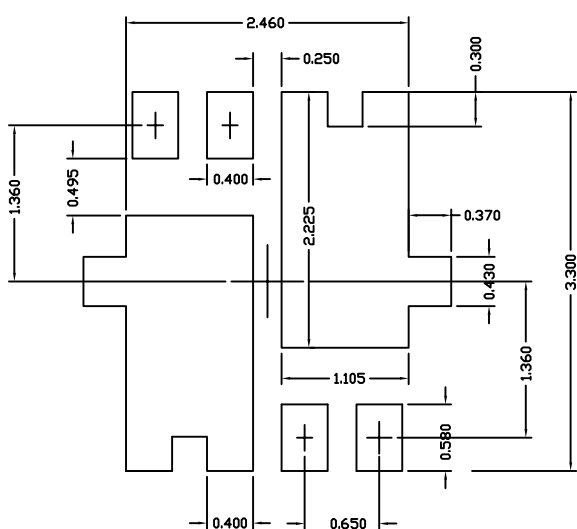
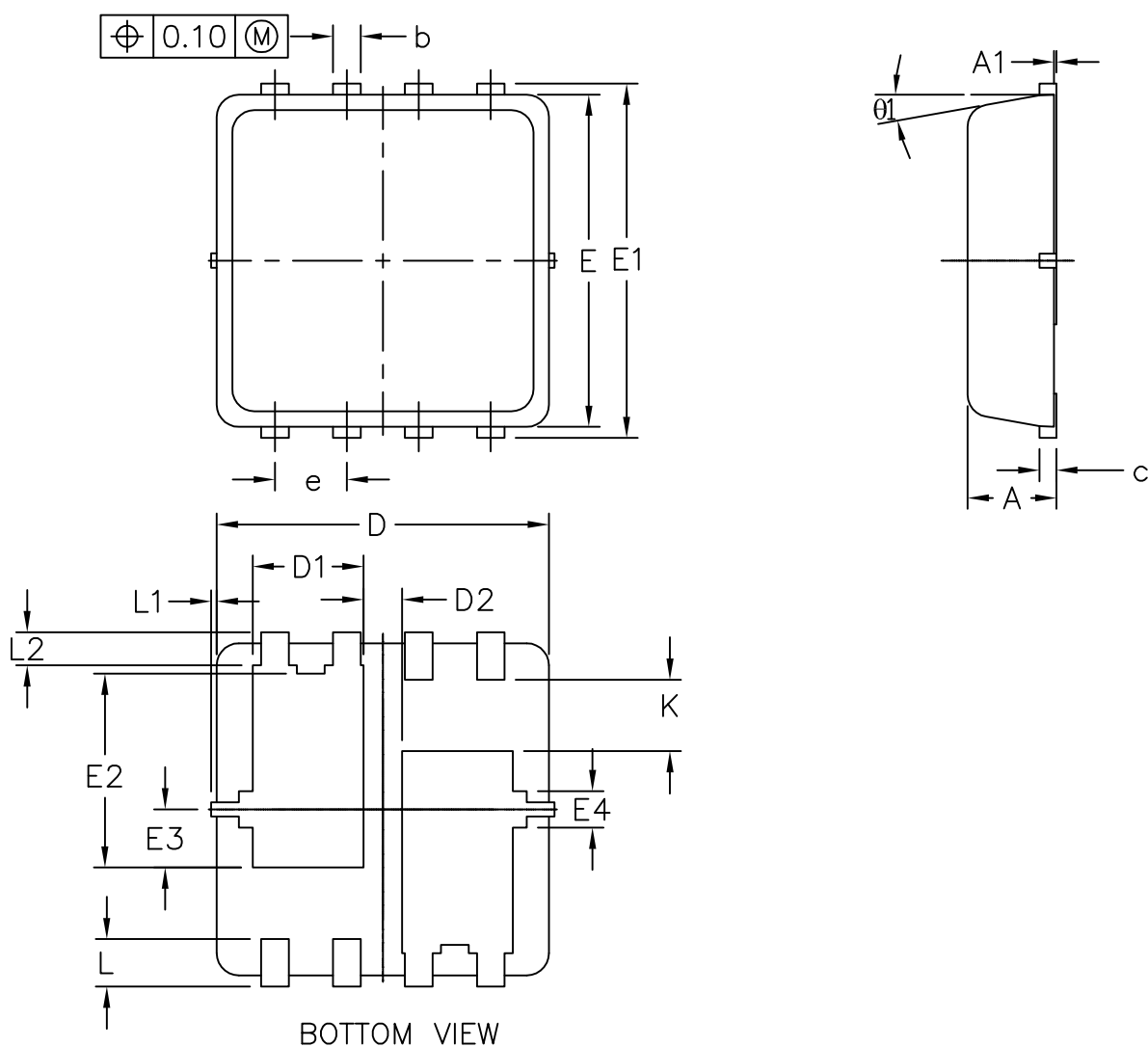


Green product

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

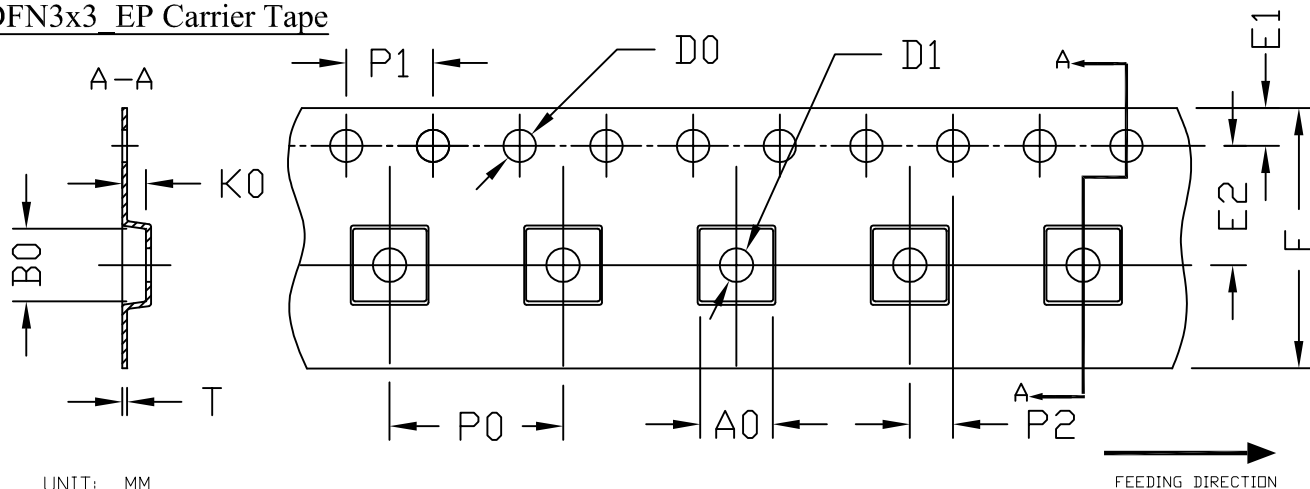


SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.70	0.80	0.90	0.028	0.031	0.035
A1	0.00	----	0.05	0.000	----	0.002
b	0.24	0.25	0.30	0.009	0.010	0.012
c	0.10	0.15	0.25	0.004	0.006	0.010
D	2.90	3.00	3.10	0.114	0.118	0.122
D1	0.85	1.00	1.15	0.033	0.039	0.045
D2	0.25	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°

CONVERTED INCH DIMENSIONS ARE NOT NECESSARILY EXACT.



DFN3x3 EP Carrier Tape

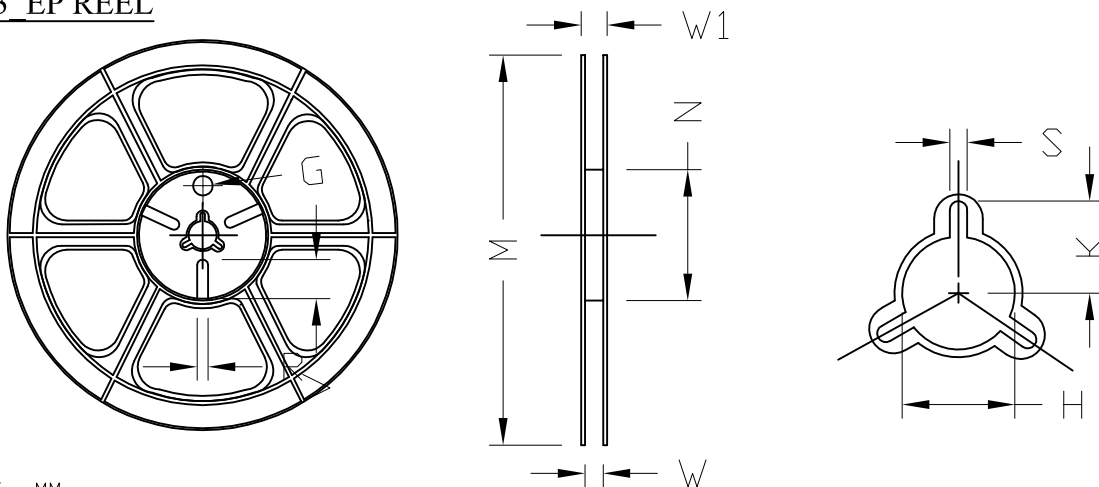


UNIT: MM

FEEDING DIRECTION

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	---	---	---

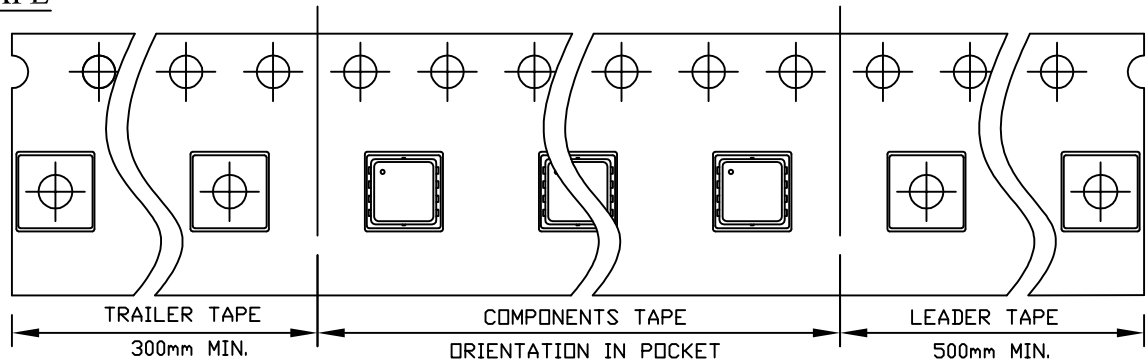


DFN3x3 EP TAPE

Leader / Trailer
& Orientation

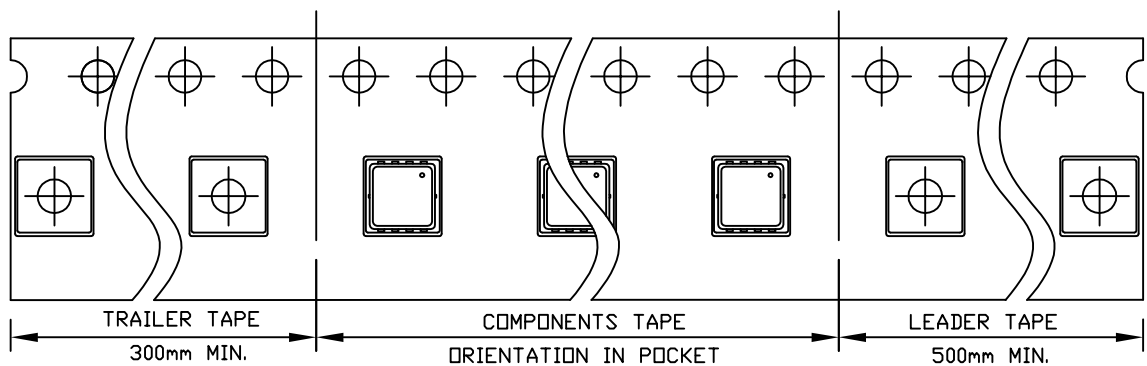
MOS

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

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	$\Delta T_j = 100^\circ\text{C}$	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 = $\text{Chi}^2 \times 10^9 / [2 (N) (H) (Af)] = 3.82$

MTTF = $10^9 / \text{FIT} = 29919$ 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]** = $\text{Exp} [E_a / k (1/T_j u - 1/T_j s)]$

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, $8.617164 \times 10^{-5} \text{eV} / \text{K}$