ALPHA & OMEGA SEMICONDUCTOR

AONS36314
30V N-Channel MOSFET

General Description

• Trench Power MOSFET technology
• Low $R_{DS(ON)}$
• Low Gate Charge
• High Current Capability
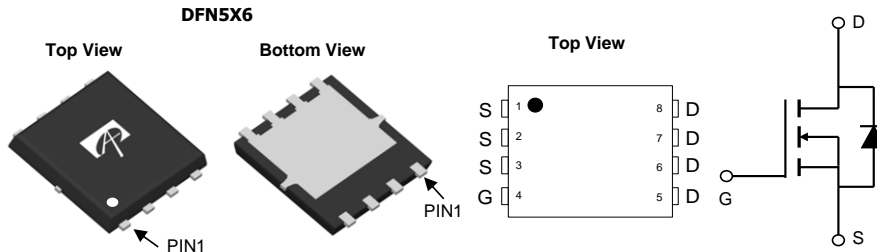• RoHS and Halogen-Free Compliant

Applications

• DC/DC Converters in Computing, Servers, and POL
• Isolated DC/DC Converters in Telecom and Industrial
• See Note I

Product Summary

V_{DS}	30V
I_D (at V_{GS}=10V)	85A
$R_{DS(ON)}$ (at V_{GS}=10V)	< 2.9mΩ
$R_{DS(ON)}$ (at V_{GS}=4.5V)	< 3.5mΩ

100% UIS Tested
100% Rg Tested

Green Product

DFN5X6

Top View   Bottom View   Top View

S	1		8	D
S	2		7	D
S	3		6	D
G	4		5	D

PIN1

Orderable Part Number	Package Type	Form	Minimum Order Quantity
AONS36314	DFN 5x6	Tape & Reel	3000

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}	±12	V
Continuous Drain Current [G]	T_C=25°C	I_D	85	A
	T_C=100°C		60	
Pulsed Drain Current [C]		I_{DM}	185	
Continuous Drain Current	T_A=25°C	I_{DSM}	36.5	A
	T_A=70°C		29	
Avalanche Current [C]		I_{AS}	75	A
Avalanche energy L=0.01mH [C]		E_{AS}	28	mJ
Power Dissipation [B]	T_C=25°C	P_D	42	W
	T_C=100°C		17	
Power Dissipation [A]	T_A=25°C	P_{DSM}	6.2	W
	T_A=70°C		4	
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	$R_{\theta JA}$	15	20	°C/W
Maximum Junction-to-Ambient [A D]	Steady-State		40	50	°C/W
Maximum Junction-to-Case	Steady-State	$R_{\theta JC}$	2.4	3	°C/W

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Electrical Characteristics (T$_J$=25°C unless otherwise noted)

Symbol	Parameter	Conditions		Min	Typ	Max	Units
STATIC PARAMETERS							
BV$_{DSS}$	Drain-Source Breakdown Voltage	ID=250µA, VGS=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$_{GS}$=±12V				±100	nA
V$_{GS(th)}$	Gate Threshold Voltage	V$_{DS}$=V$_{GS,}$ I$_D$=250µA		1.1	1.5	1.9	V
R$_{DS(ON)}$	Static Drain-Source On-Resistance	V$_{GS}$=10V, I$_D$=20A			2.4	2.9	mΩ
			T$_J$=125°C		3.4	4.1	
		V$_{GS}$=4.5V, I$_D$=20A			2.8	3.5	mΩ
g$_{FS}$	Forward Transconductance	V$_{DS}$=5V, I$_D$=20A			100		S
V$_{SD}$	Diode Forward Voltage	I$_S$=1A, V$_{GS}$=0V			0.7	1	V
I$_S$	Maximum Body-Diode Continuous Current					50	A
DYNAMIC PARAMETERS							
C$_{iss}$	Input Capacitance	V$_{GS}$=0V, V$_{DS}$=15V, f=1MHz			1890		pF
C$_{oss}$	Output Capacitance				395		pF
C$_{rss}$	Reverse Transfer Capacitance				55		pF
R$_g$	Gate resistance	f=1MHz		1.2	2.3	3.6	Ω
SWITCHING PARAMETERS							
Q$_g$(10V)	Total Gate Charge	V$_{GS}$=10V, V$_{DS}$=15V, I$_D$=20A			27.5	40	nC
Q$_g$(4.5V)	Total Gate Charge				11.5	18	nC
Q$_{gs}$	Gate Source Charge				6		nC
Q$_{gd}$	Gate Drain Charge				2.5		nC
t$_{D(on)}$	Turn-On DelayTime	V$_{GS}$=10V, V$_{DS}$=15V, R$_L$=0.75Ω, R$_{GEN}$=3Ω			7.5		ns
t$_r$	Turn-On Rise Time				3.5		ns
t$_{D(off)}$	Turn-Off DelayTime				30		ns
t$_f$	Turn-Off Fall Time				4		ns
t$_{rr}$	Body Diode Reverse Recovery Time	I$_F$=20A, di/dt=500A/µs			12		ns
Q$_{rr}$	Body Diode Reverse Recovery Charge	I$_F$=20A, di/dt=500A/µs			21		nC

A. The value of R$_{θJA}$ 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$_{DSM}$ 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 <300 µs 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 heatsin k, 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 in^2 FR-4 board with 2oz. Copper, in a still air environment with T$_A$=25°C.
I. For application requiring slow >1ms turn-on/turn-off, please consult AOS FAE for proper product selection.

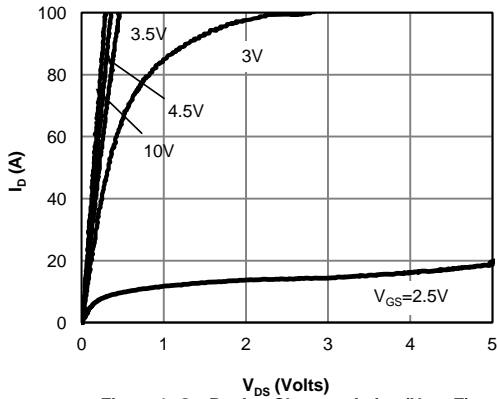## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

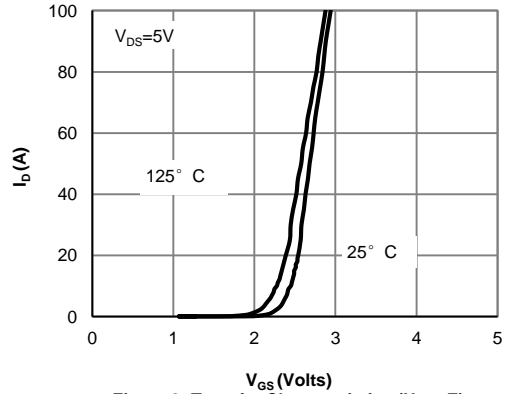

Figure 1: On-Region Characteristics (Note E)

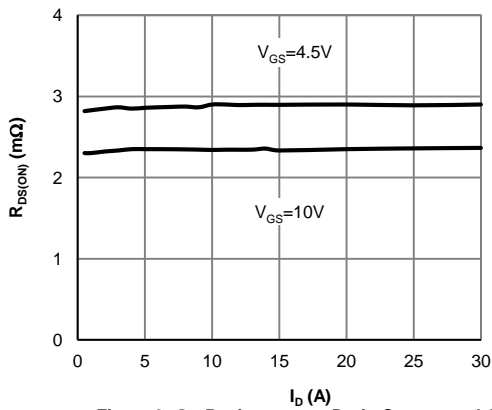Figure 2: Transfer Characteristics (Note E)

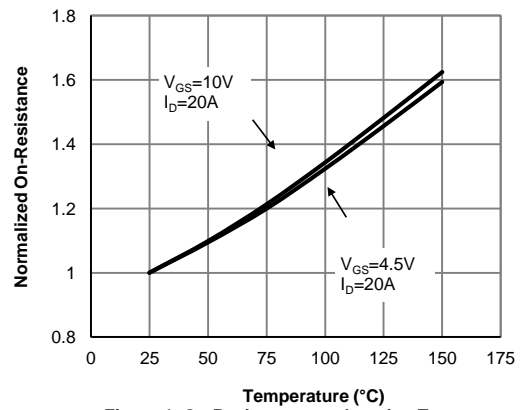Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

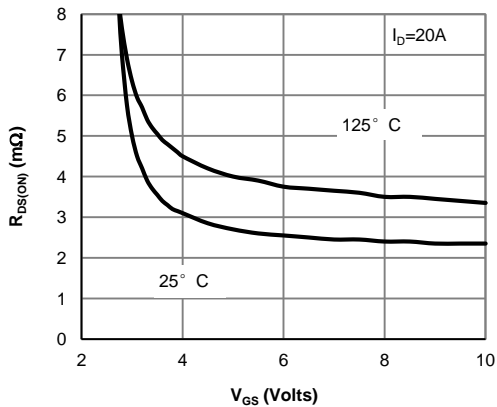Figure 4: On-Resistance vs. Junction Temperature (Note E)

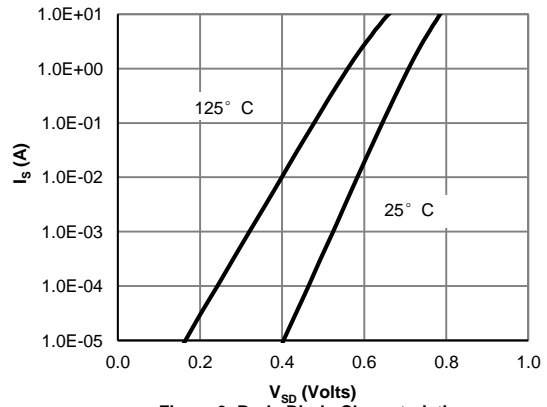Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

Figure 6: Body-Diode Characteristics (Note E)
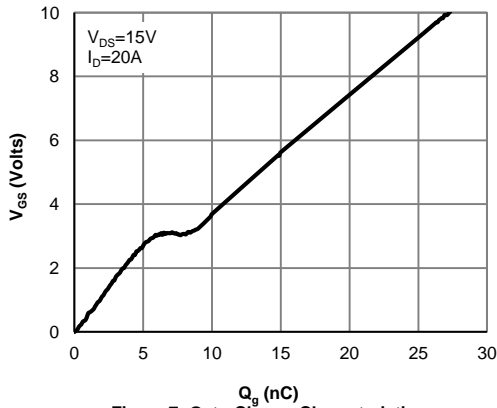
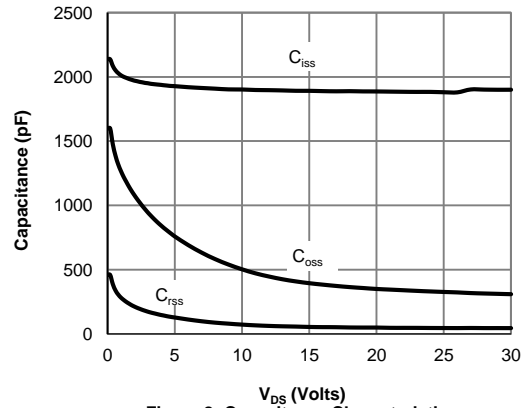**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**

Figure 7: Gate-Charge Characteristics
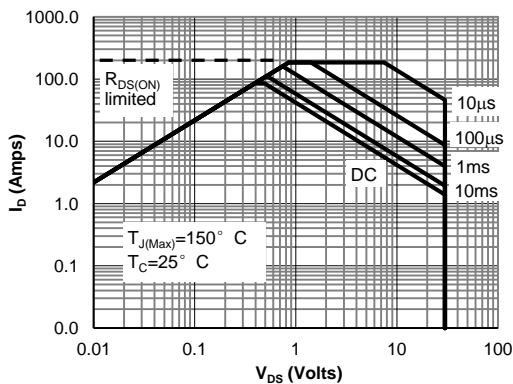

Figure 8: Capacitance Characteristics

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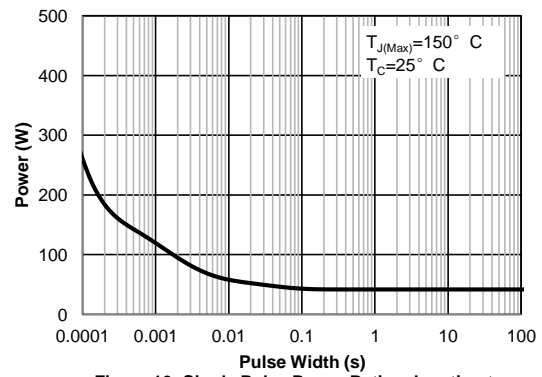Safe Operating Area (Note F)

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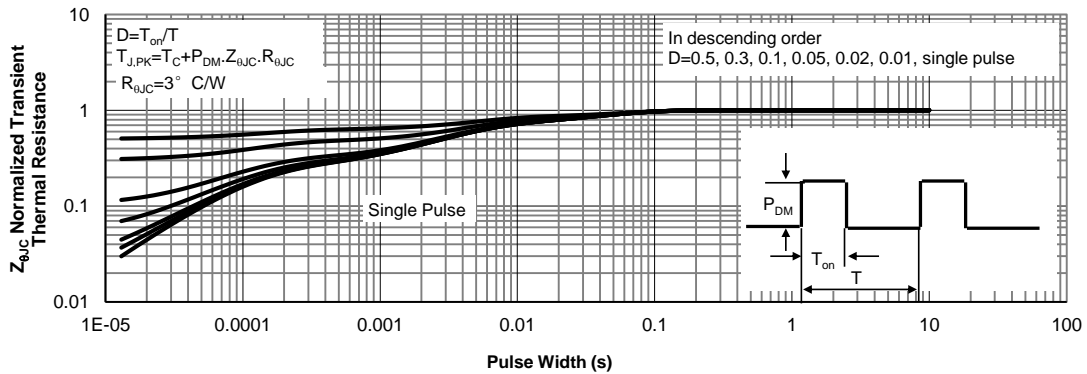Case (Note F)

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

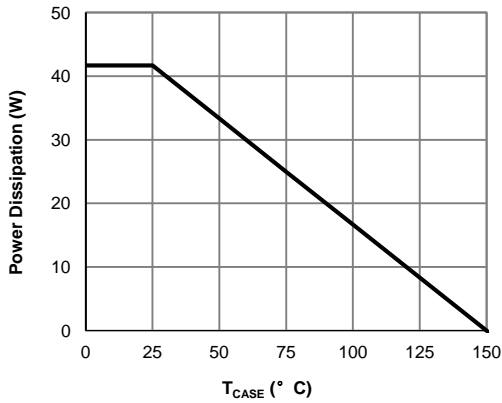## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

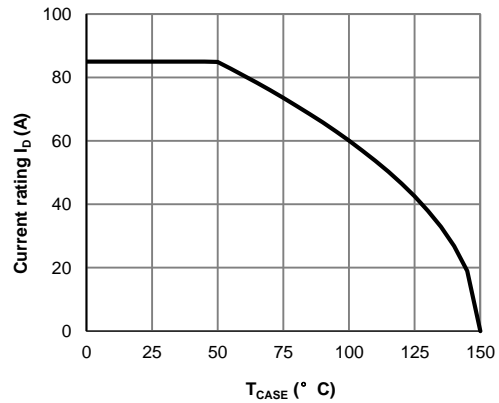
Figure 12: Power De-rating (Note F)
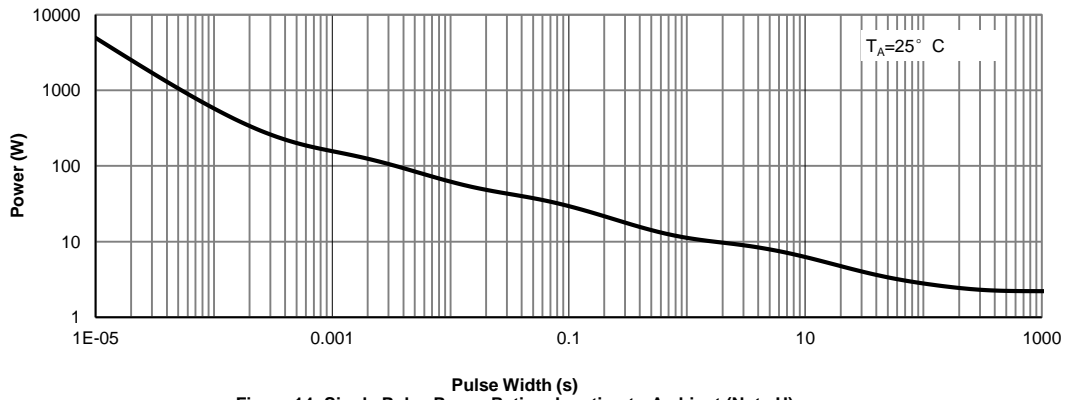

Figure 13: Current De-rating (Note F)

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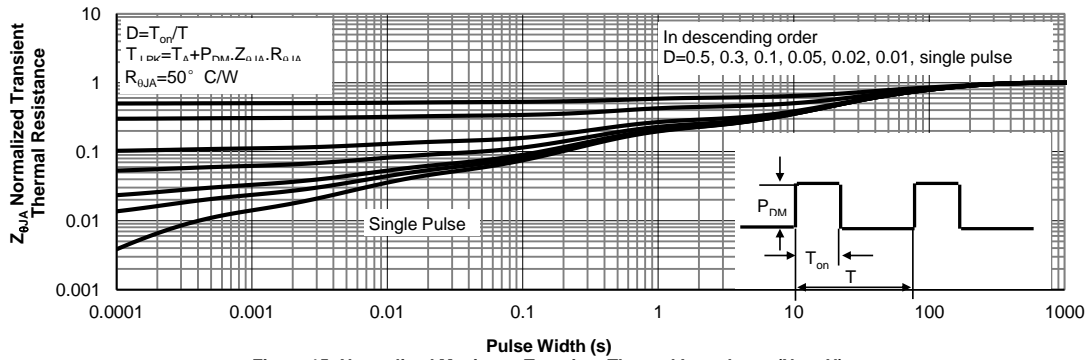

Figure 15: Normalized Maximum Transient Thermal Impedance (Note H)

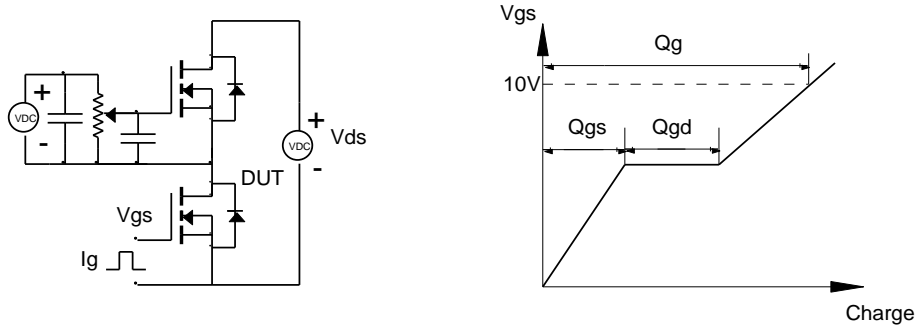Figure A: Gate Charge Test Circuit & Waveforms

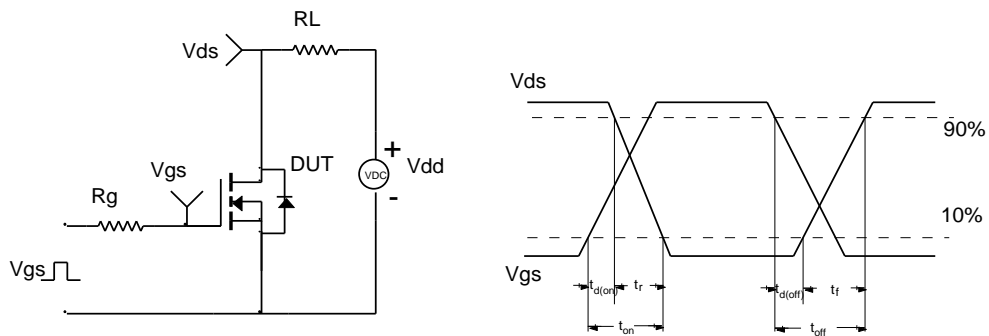Figure B: Resistive Switching Test Circuit & Waveforms

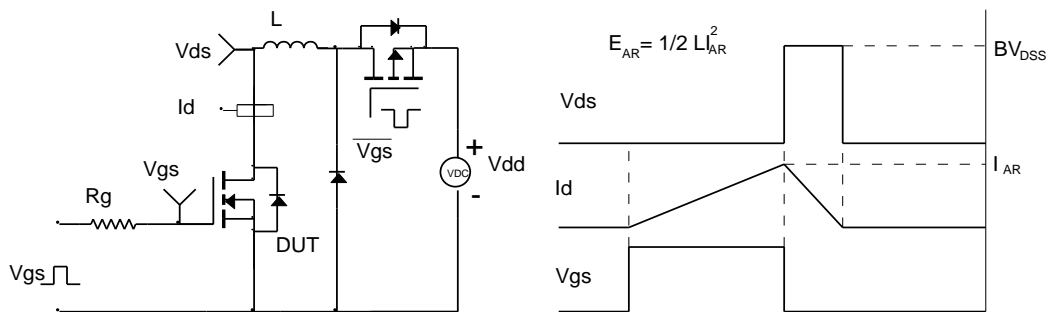Figure C: Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

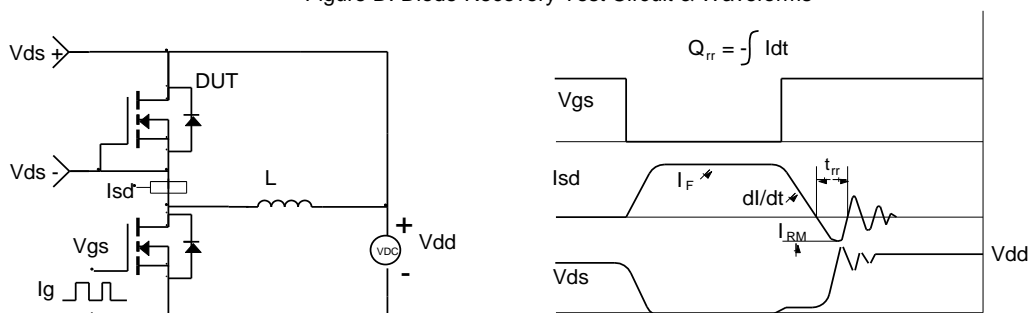$$E_{AR} = 1/2 \, LI_{AR}^2$$

Figure D: Diode Recovery Test Circuit & Waveforms

$$Q_{rr} = -\int Idt$$

ALPHA & OMEGA
SEMICONDUCTOR

This AOS product reliability report summarizes the qualification result for AONS36314. 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 AONS36314 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 x 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
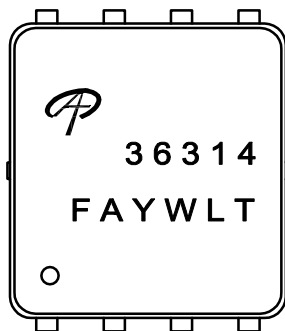**Tj u** =The use junction temperature in degree (Kelvin), K = C+273.16
k = Boltzmann's constant, 8.617164 X 10^{-5} eV / K

DFN5x6 PACKAGE MARKING DESCRIPTION
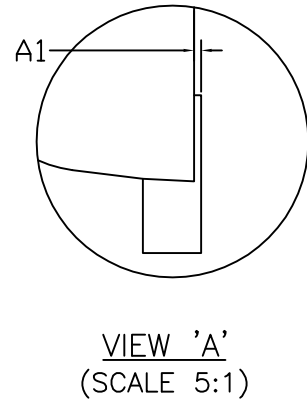
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 AP
    36314
   FAYWLT
  O
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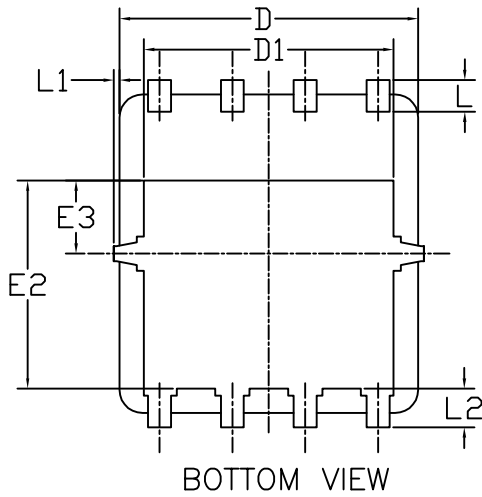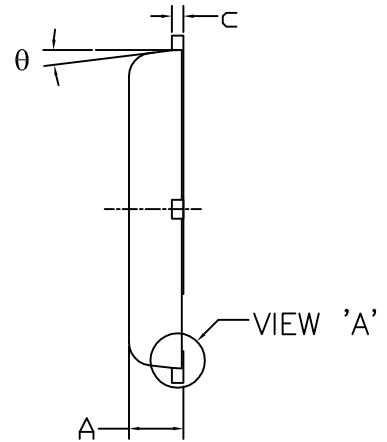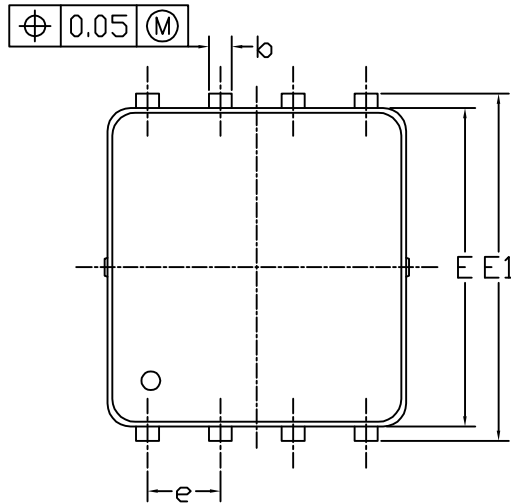
Green product

NOTE:
LOGO   - AOS Logo
36314   - Part number code
F   - Fab code
A   - Assembly location code
Y   - Year code
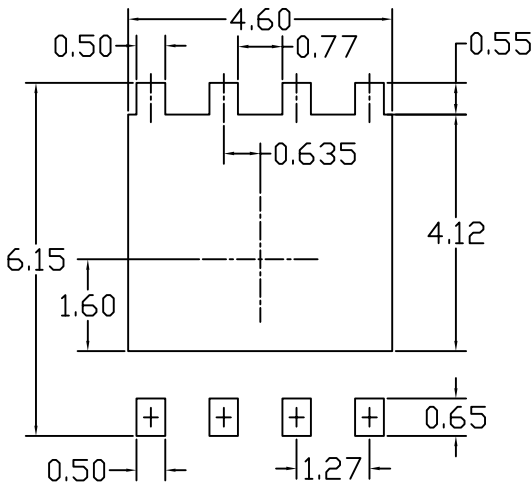W   - Week code
L&T   - Assembly lot code

PART NO.	DESCRIPTION	CODE
AONS36314	Green product	36314

ALPHA & OMEGA SEMICONDUCTOR

DFN5x6_8L_EP1_P PACKAGE OUTLINE

⊕ | 0.05 | Ⓜ

VIEW 'A'

VIEW 'A'
(SCALE 5:1)

BOTTOM VIEW

RECOMMENDED LAND PATTERN

UNIT: mm

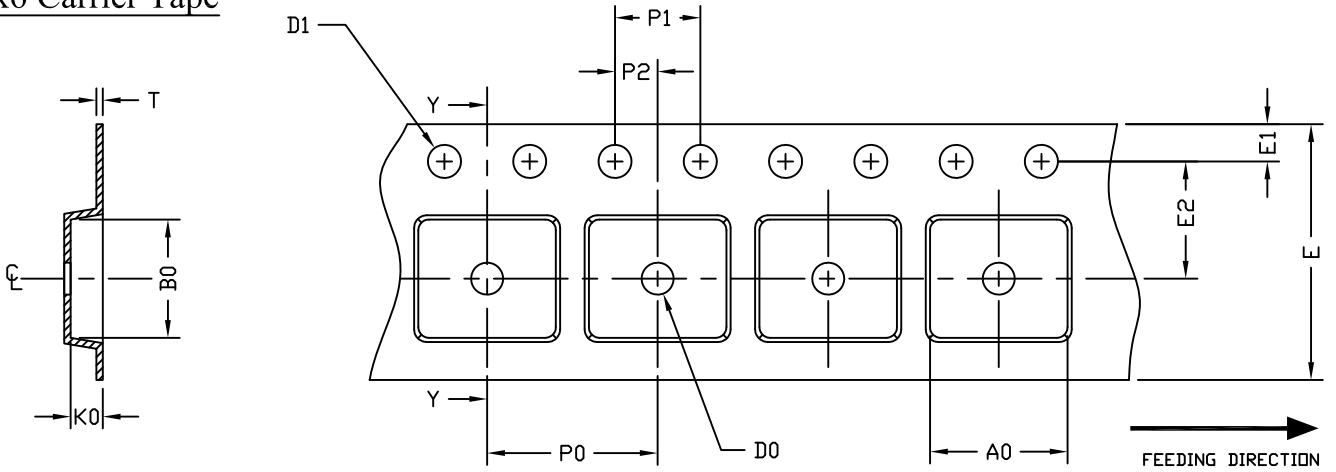| SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.85	0.95	1.00	0.033	0.037	0.039
A1	0.00	——	0.05	0.000	——	0.002
b	0.30	0.40	0.50	0.012	0.016	0.020
c	0.15	0.20	0.25	0.006	0.008	0.010
D	5.10	5.20	5.30	0.201	0.205	0.209
D1	4.25	4.35	4.45	0.167	0.171	0.175
E	5.45	5.55	5.65	0.215	0.219	0.222
E1	5.95	6.05	6.15	0.234	0.238	0.242
E2	3.525	3.625	3.725	0.139	0.143	0.147
E3	1.175	1.275	1.375	0.046	0.050	0.054
e	1.27 BSC			0.050 BSC		
L	0.45	0.55	0.65	0.018	0.022	0.026
L1	0	——	0.15	0	——	0.006
L2	0.68 REF			0.027 REF		
θ	0°	——	10°	0°	——	10°

NOTE
1. PACKAGE 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.
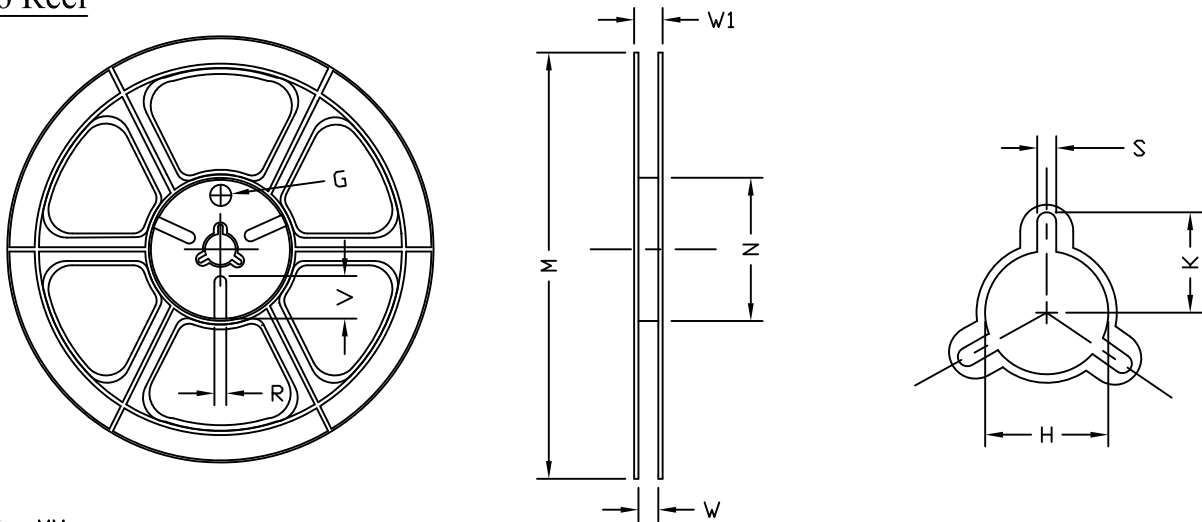   CONVERTED INCH DIMENSIONS ARE NOT NECESSARILY EXACT.

DFN5x6 Carrier Tape

UNIT: MM

PACKAGE	A0	B0	K0	D0	D1	E	E1	E2	P0	P1	P2	T
DFN5x6 (12 mm)	6.30 ±0.10	5.45 ±0.10	1.30 ±0.10	1.50 MIN.	1.55 ±0.05	12.00 ±0.30	1.75 ±0.10	5.50 ±0.10	8.00 ±0.10	4.00 ±0.10	2.00 ±0.10	0.30 ±0.05

DFN5x6 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	---	---	---

DFN5x6 Tape

Leader / Trailer & Orientation

Unit Per Reel: 3000pcs

TRAILER TAPE
300 mm MIN. OR
75 EMPTY POCKETS

COMPONENTS TAPE
ORIENTATION IN POCKET

LEADER TAPE
500 mm MIN. OR
125 EMPTY POCKETS