# AON2800

## 20V Dual N-Channel MOSFET

## General Description

The AON2800 combines advanced trench MOSFET technology with a low resistance package to provide extremely low $R_{DS(ON)}$. This device is ideal for load switch and battery protection applications.

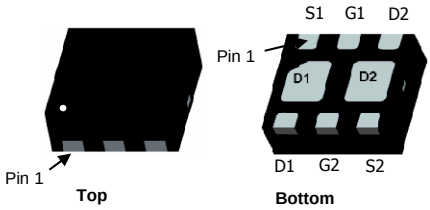
## Product Summary

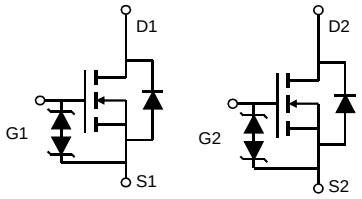
| | |
|---|---|
| $V_{DS}$ | 20V |
| $I_D$ (at $V_{GS}$=4.5V) | 4.5A |
| $R_{DS(ON)}$ (at $V_{GS}$=4.5V) | < 47mΩ |
| $R_{DS(ON)}$ (at $V_{GS}$=2.5V) | < 65mΩ |

***ESD Protected***

Green Product

**DFN 2x2 Package**




**Absolute Maximum Ratings $T_A$=25°C unless otherwise noted**

| Parameter | | Symbol | Maximum | Units |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | 20 | V |
| Gate-Source Voltage | | $V_{GS}$ | ±8 | V |
| Continuous Drain Current | $T_A$=25°C | $I_D$ | 4.5 | A |
| | $T_A$=70°C | | 3.8 | |
| Pulsed Drain Current [C] | | $I_{DM}$ | 24 | |
| Power Dissipation [B] | $T_A$=25°C | $P_D$ | 1.5 | W |
| | $T_A$=70°C | | 0.95 | |
| 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 | $R_{\theta JA}$ | 35 | 45 | °C/W |
| Maximum Junction-to-Ambient [A] | Steady-State | | 65 | 85 | °C/W |
| Maximum Junction-to-Ambient [B] | t ≤ 10s | $R_{\theta JA}$ | 120 | 155 | °C/W |
| Maximum Junction-to-Ambient [B] | Steady-State | | 175 | 235 | °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 | 20 | | | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$=20V, $V_{GS}$=0V | | | 1 | µA |
| | | $T_J$=55°C | | | 5 | |
| $I_{GSS}$ | Gate-Body leakage current | $V_{DS}$=0V, $V_{GS}$= ±8V | | | 20 | µA |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$=$V_{GS}$ $I_D$=250µA | 0.4 | 0.8 | 1.2 | V |
| $I_{D(ON)}$ | On state drain current | $V_{GS}$=4.5V, $V_{DS}$=5V | 24 | | | A |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$=4.5V, $I_D$=4A | | 37 | 47 | mΩ |
| | | $T_J$=125°C | | 55 | 70 | |
| | | $V_{GS}$=2.5V, $I_D$=3A | | 47 | 65 | mΩ |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$=5V, $I_D$=4A | | 14 | | S |
| $V_{SD}$ | Diode Forward Voltage | $I_S$=1A,$V_{GS}$=0V | | 0.7 | 1 | V |
| $I_S$ | Maximum Body-Diode Continuous Current | | | | 1.5 | A |
| **DYNAMIC PARAMETERS** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{GS}$=0V, $V_{DS}$=10V, f=1MHz | 285 | 360 | 435 | pF |
| $C_{oss}$ | Output Capacitance | | 45 | 65 | 85 | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | 30 | 50 | 70 | pF |
| $R_g$ | Gate resistance | $V_{GS}$=0V, $V_{DS}$=0V, f=1MHz | 1.7 | 3.5 | 5.3 | Ω |
| **SWITCHING PARAMETERS** | | | | | | |
| $Q_g$(4.5V) | Total Gate Charge | $V_{GS}$=4.5V, $V_{DS}$=10V, $I_D$=4A | | 4.15 | 6 | nC |
| $Q_{gs}$ | Gate Source Charge | | | 0.55 | | nC |
| $Q_{gd}$ | Gate Drain Charge | | | 1.15 | | nC |
| $t_{D(on)}$ | Turn-On DelayTime | $V_{GS}$=4.5V, $V_{DS}$=10V, $R_L$=2.5Ω, $R_{GEN}$=3Ω | | 9.5 | | ns |
| $t_r$ | Turn-On Rise Time | | | 43 | | ns |
| $t_{D(off)}$ | Turn-Off DelayTime | | | 26 | | ns |
| $t_f$ | Turn-Off Fall Time | | | 39 | | ns |
| $t_{rr}$ | Body Diode Reverse Recovery Time | $I_F$=4A, dI/dt=100A/µs | | 11 | | ns |
| $Q_{rr}$ | Body Diode Reverse Recovery Charge | $I_F$=4A, dI/dt=100A/µs | | 3 | | nC |

A: The value of $R_{\theta JA}$ 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 $R_{\theta JA}$ 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 to.
B. The value of $R_{\theta JA}$ is measured with the device mounted on a minimum pad board with 2oz. Copper, in a still air environment with $T_A$=25° C. The Power dissipation $P_{DSM}$ is based on $R_{\theta JA}$ 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 to.
C. The $R_{\theta JA}$ is the sum of the thermal impedence from junction to case $R_{\theta JC}$ and case to ambient.
D. The static characteristics in Figures 1 to 6 are obtained using <300 µs pulses, duty cycle 0.5% max.
E. 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. The SOA curve provides a single pulse rating.

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

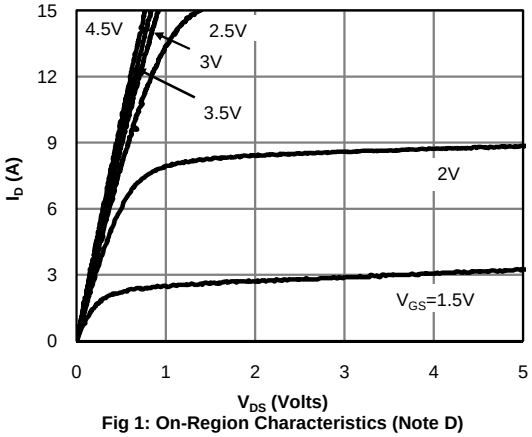



Fig 1: On-Region Characteristics (Note D)

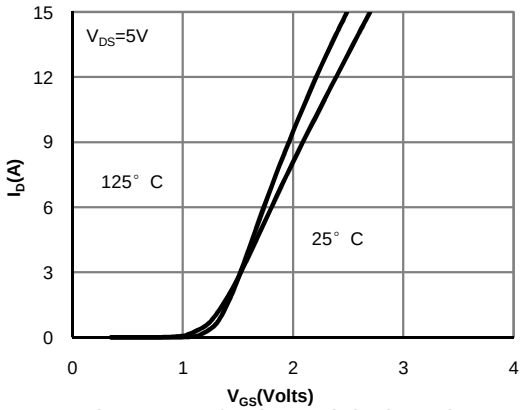



Figure 2: Transfer Characteristics (Note D)

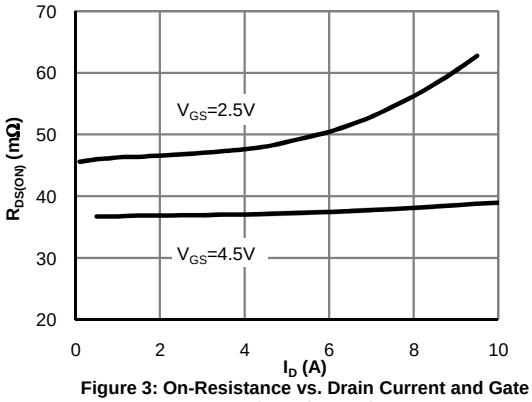



Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note D)

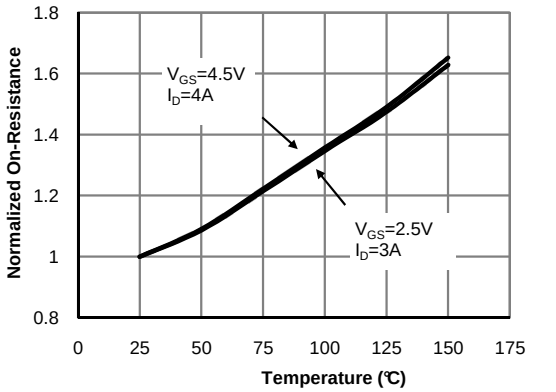



Figure 4: On-Resistance vs. Junction Temperature (Note D)

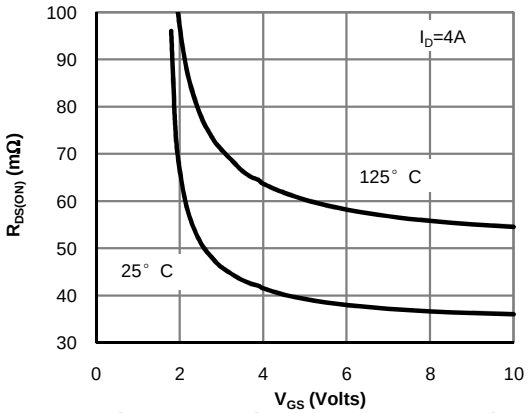



Figure 5: On-Resistance vs. Gate-Source Voltage (Note D)

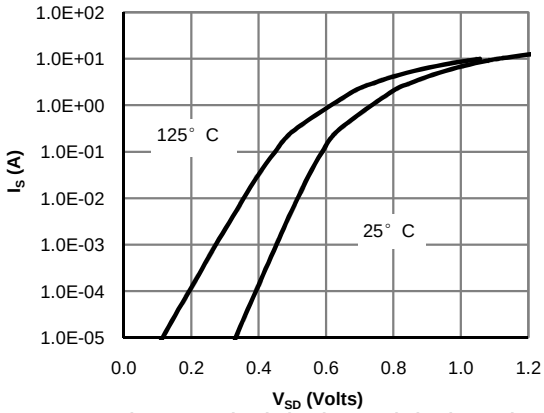



Figure 6: Body-Diode Characteristics (Note D)

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

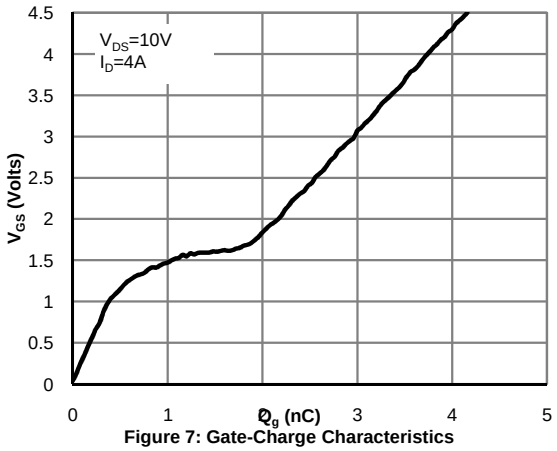



Figure 7: Gate-Charge Characteristics

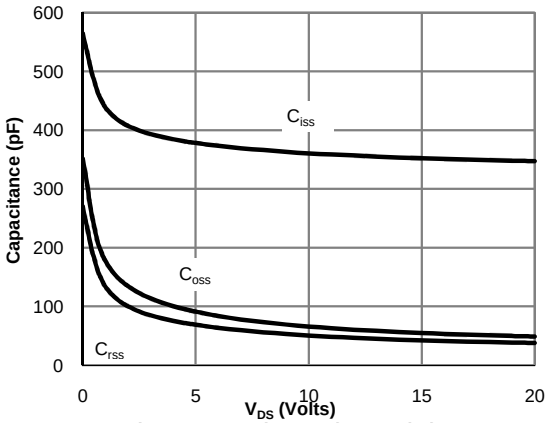



Figure 8: Capacitance Characteristics

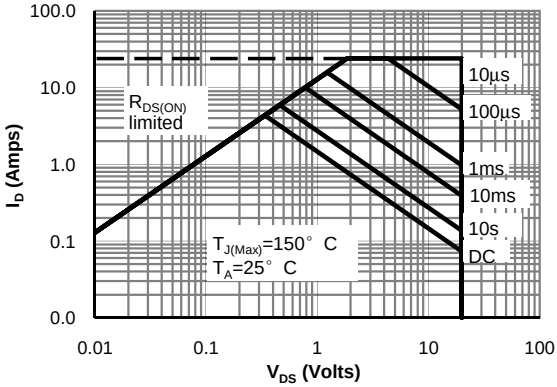



Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

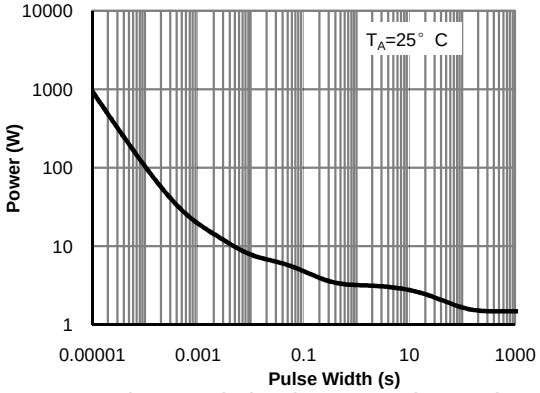



Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

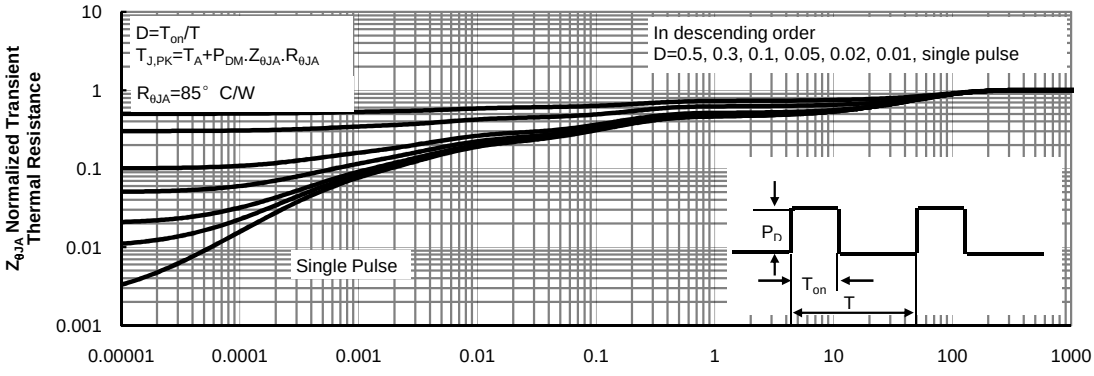
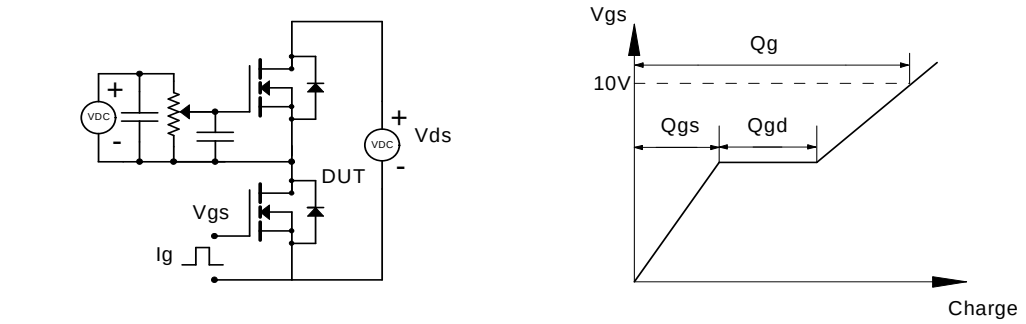
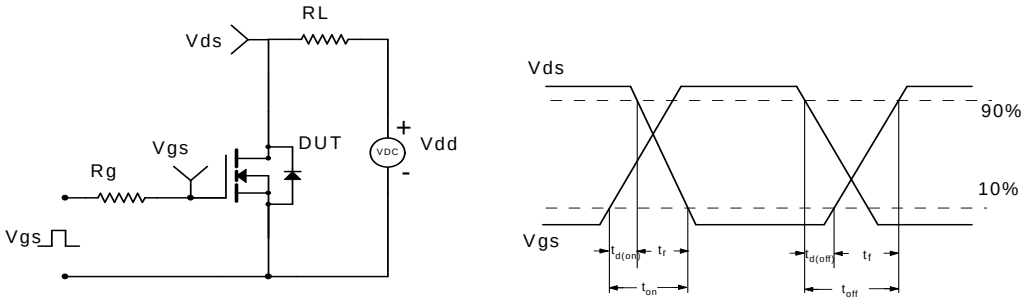



Figure 11: Normalized Maximum Transient Thermal Impedance (Note E)

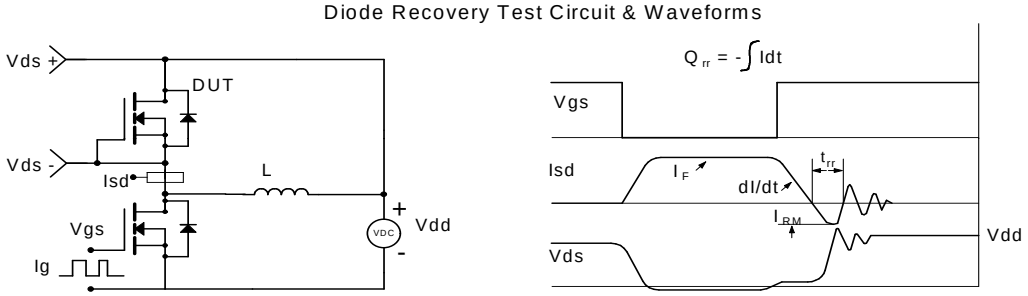
## Gate Charge Test Circuit & Waveform




## Resistive Switching Test Circuit & Waveforms



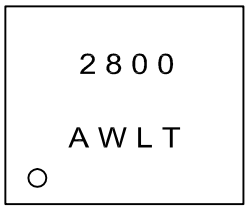

## Diode Recovery Test Circuit & Waveforms



ALPHA & OMEGA SEMICONDUCTOR

| Document No. | PD-01396 |
|---|---|
| Version | A |
| Title | AON2800 Marking Description |

# DFN2X2 PACKAGE MARKING DESCRIPTION




Green product

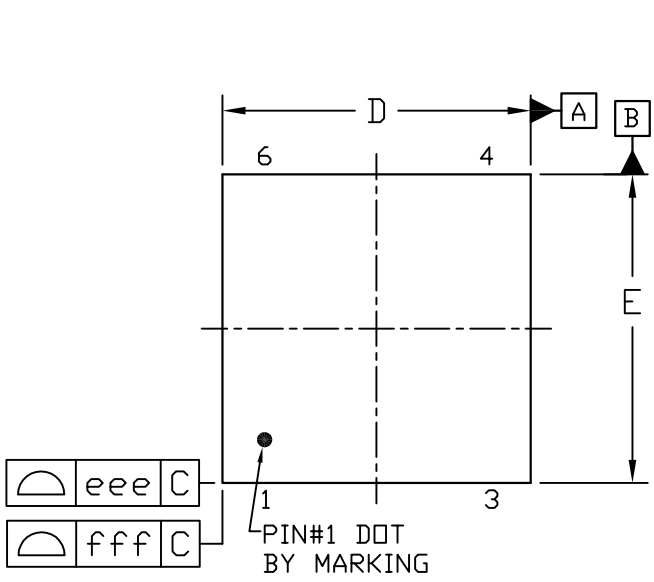
NOTE:
2800 - Product Number Code
A - Assembly location code
W - Week code & Year Code
L&T - Assembly lot code

| PART NO. | DESCRIPTION | CODE |
|---|---|---|
| AON2800 | Green product | 2800 |
| AON2800L | Green product | 2800 |

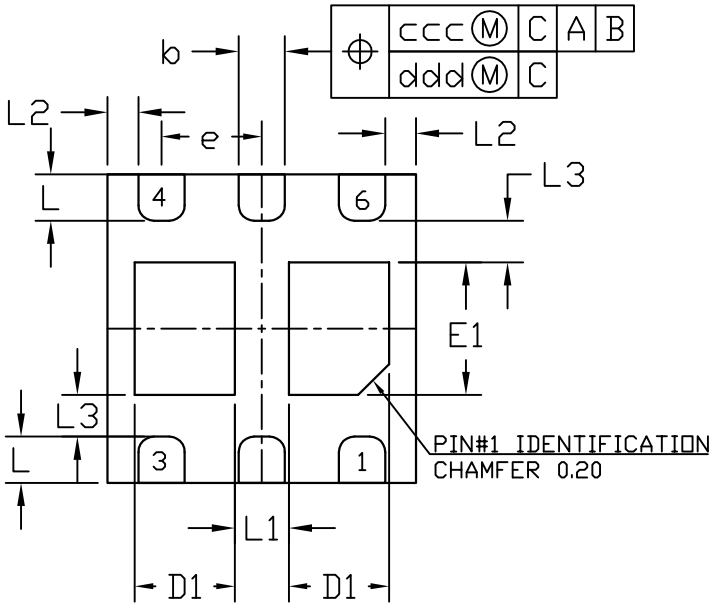
ALPHA & OMEGA SEMICONDUCTOR

| Document No. | PO-00065 |
|---|---|
| Version | B |

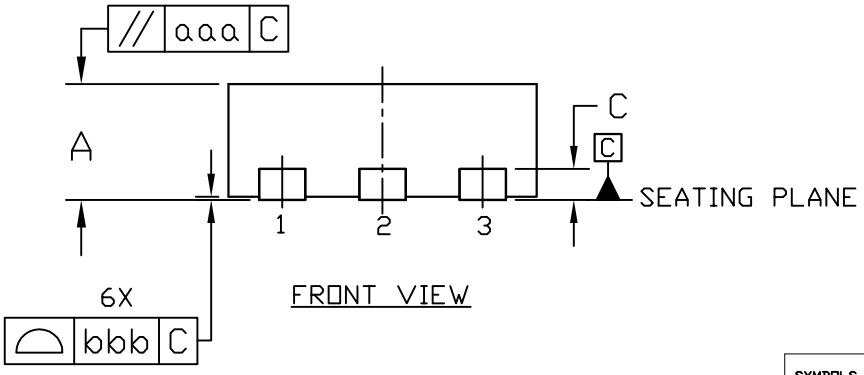
# DFN2x2_6L_EP2_S PACKAGE OUTLINE




TOP VIEW

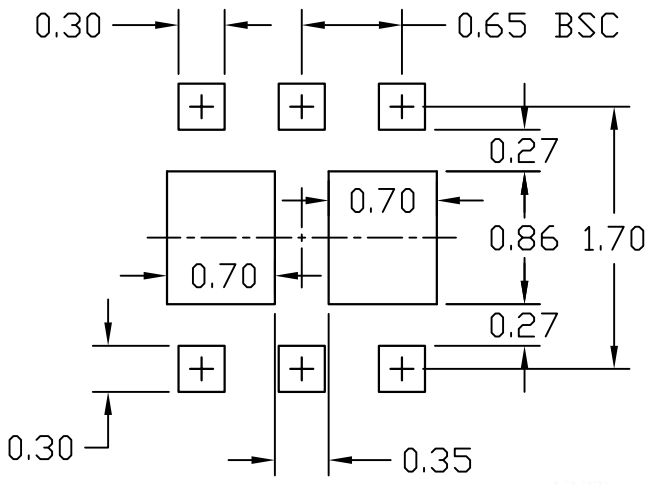



BOTTOM VIEW




FRONT VIEW

RECOMMENDED LAND PATTERN




UNIT: mm

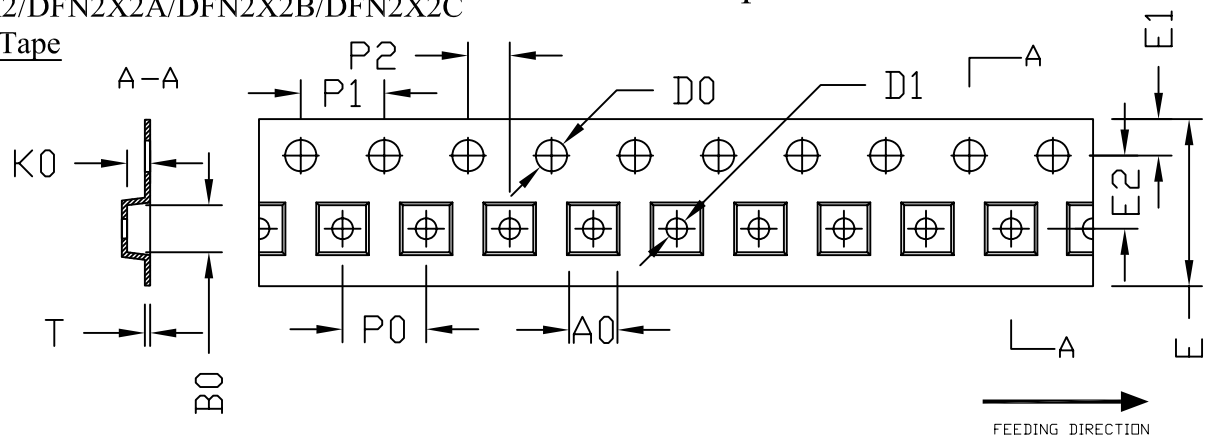
| SYMBOLS | DIMENSIONS IN MILLIMETERS | | | DIMENSIONS IN INCHES | | |
|---|---|---|---|---|---|---|
| | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 0.70 | 0.75 | 0.80 | 0.028 | 0.030 | 0.031 |
| b | 0.25 | 0.30 | 0.35 | 0.010 | 0.012 | 0.014 |
| c | | 0.20 Ref. | | | 0.008 Ref. | |
| D | 1.90 | 2.00 | 2.10 | 0.075 | 0.079 | 0.083 |
| D1 | 0.620 | 0.650 | 0.680 | 0.024 | 0.026 | 0.027 |
| E | 1.90 | 2.00 | 2.10 | 0.075 | 0.079 | 0.083 |
| E1 | 0.76 | 0.86 | 0.96 | 0.030 | 0.034 | 0.038 |
| e | | 0.65 BSC | | | 0.026 BSC | |
| L | 0.25 | 0.30 | 0.35 | 0.010 | 0.012 | 0.014 |
| L1 | 0.320 | 0.350 | 0.380 | 0.013 | 0.014 | 0.015 |
| L2 | 0.170 | 0.200 | 0.230 | 0.007 | 0.008 | 0.009 |
| L3 | 0.240 | 0.270 | 0.300 | 0.009 | 0.011 | 0.012 |
| aaa | --- | 0.100 | --- | --- | 0.004 | --- |
| bbb | --- | 0.080 | --- | --- | 0.003 | --- |
| ccc | --- | 0.100 | --- | --- | 0.004 | --- |
| ddd | --- | 0.050 | --- | --- | 0.002 | --- |
| eee | --- | 0.150 | --- | --- | 0.006 | --- |
| fff | --- | 0.150 | --- | --- | 0.006 | --- |

NOTE
1. CONTROLLING DIMENSION IS MILLIMETER.
   CONVERTED INCH DIMENSIONS ARE NOT NECESSARILY EXACT.

**ALPHA & OMEGA SEMICONDUCTOR**

# DFN 2x2/DFN2x2A/DFN2x2B/DFN2x2C Tape and Reel Data

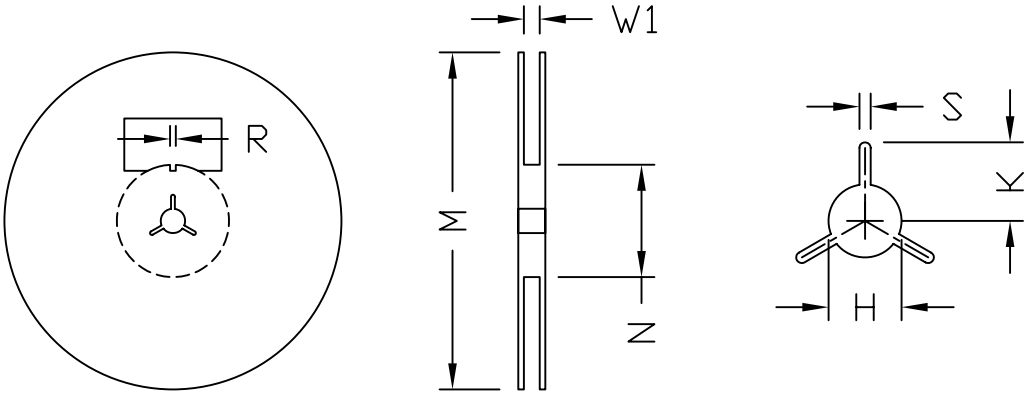
## DFN2X2/DFN2X2A/DFN2X2B/DFN2X2C Carrier Tape




UNIT: MM

| OPTION | PACKAGE | A0 | B0 | K0 | D0 | D1 | E | E1 | E2 | P0 | P1 | P2 | T |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | DFN 2X2<br>DFN 2X2A<br>DFN 2X2B<br>DFN 2X2C | 2.25 ±0.05 | 2.25 ±0.05 | 1.00 ±0.05 | 1.50 +0.10 −0 | 1.00 +0.25 −0 | 8.00 +0.30 −0.10 | 1.75 ±0.10 | 3.50 ±0.05 | 4.00 ±0.10 | 4.00 ±0.10 | 2.00 ±0.05 | 0.254 ±0.02 |
| 2 | | 2.30 ±0.20 | 2.30 ±0.20 | 1.00 ±0.20 | 1.50 +0.10 −0 | 1.00 MIN. | 8.00 +0.30 −0.10 | 1.75 ±0.10 | 3.50 ±0.05 | 4.00 ±0.20 | 4.00 ±0.20 | 2.00 ±0.05 | 0.30 ±0.05 |

## DFN2X2/DFN2X2A/DFN2X2B/DFN2X2C REEL



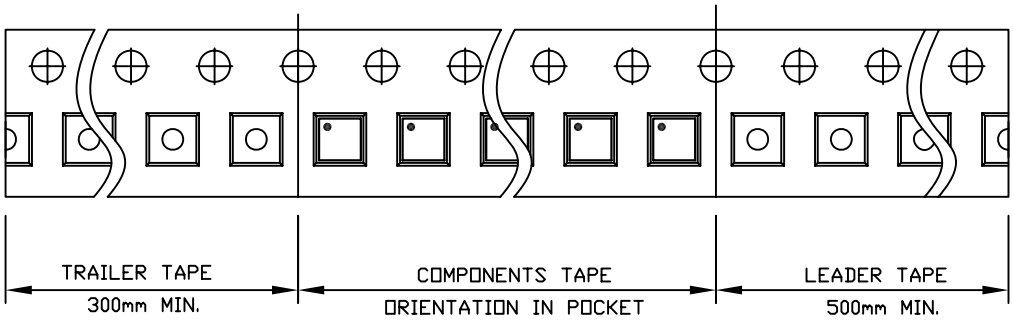

UNIT: MM

| TAPE SIZE | REEL SIZE | M | N | W1 | H | S | K | R |
|---|---|---|---|---|---|---|---|---|
| 8 | ø180 | ø180.0 ±0.50 | 60.0 ±0.50 | 8.4 +1.5 −0.0 | 13.0 ±0.20 | 1.5 MIN. | 13.5 MIN. | 3.0 ±0.50 |

## DFN2X2/DFN2X2A/DFN2X2B/DFN2X2C TAPE

Leader / Trailer & Orientation

Unit Per Reel: 3000pcs



ALPHA & OMEGA SEMICONDUCTOR

# AOS Semiconductor
# Product Reliability Report

## AON2800, rev A

**Plastic Encapsulated Device**

**ALPHA & OMEGA Semiconductor, Inc**

**www.aosmd.com**

This AOS product reliability report summarizes the qualification result for AON2800. 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 AON2800 passes AOS quality and reliability requirements. The released product will be categorized by the process family and be monitored on a quarterly basis for continuously improving the product quality.

## Table of Contents:



## I. Product Description:

The AON2800 combines advanced trench MOSFET technology with a low resistance package to provide extremely low $R_{DS(ON)}$. This device is ideal for load switch and battery protection applications.

-RoHS Compliant
-Halogen Free

Detailed information refers to datasheet.

## II. Die / Package Information:

| | **AON2800** |
|---|---|
| **Process** | Standard sub-micron<br>Low voltage N channel |
| **Package Type** | DFN 2x2 |
| **Lead Frame** | Copper |
| **Die Attach** | Silver epoxy |
| **Bonding Wire** | Au wire |
| **Mold Material** | Epoxy resin with silica filler |
| **MSL (moisture sensitive level)** | Level 1 based on J-STD-020 |

**Note *** based on information provided by assembler and mold compound supplier

ALPHA & OMEGA SEMICONDUCTOR

## III. Result of Reliability Stress for AON2800

| Test Item | Test Condition | Time Point | Lot Attribution | Total Sample size | Number of Failures | Standard |
|---|---|---|---|---|---|---|
| MSL Precondition | 168hr 85℃ /85%RH +3 cycle reflow@260℃ | - | 11 lots | 1815pcs | 0 | JESD22-A113 |
| HTGB | Temp = 150°c, Vgs=100% of Vgsmax | 168hrs<br>500 hrs<br>1000 hrs | 1 lot<br>(Note A*) | 77pcs<br>77pcs / lot | 0 | JESD22-A108 |
| HTRB | Temp = 150°c, Vds=80% of Vdsmax | 168hrs<br>500 hrs<br>1000 hrs | 1 lot<br>(Note A*) | 77pcs<br>77pcs / lot | 0 | JESD22-A108 |
| HAST | 130 +/- 2°c, 85%RH, 33.3 psi, Vgs = 100% of Vgs max | 100 hrs | 11 lots<br>(Note A*) | 605pcs<br>55pcs / lot | 0 | JESD22-A110 |
| Pressure Pot | 121°c, 29.7psi, RH=100% | 96 hrs | 11 lots<br>(Note A*) | 605pcs<br>55pcs / lot | 0 | JESD22-A102 |
| Temperature Cycle | -65°c to 150°c, air to air | 250 / 500 cycles | 11 lots<br>(Note A*) | 605pcs<br>55pcs / lot | 0 | JESD22-A104 |

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

## IV. Reliability Evaluation

### FIT rate (per billion): 137
### MTTF = 833 years

The presentation of FIT rate for the individual product reliability is restricted by the actual burn-in sample size of the selected product (AON2800). 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)**]** = $1.83 \times 10^9$ **/ [**2x2x77x168 x258**]** = 137
**MTTF =** $10^9$ / FIT =$7.30 \times 10^6$hrs = 833 years

**Chi²** = Chi Squared Distribution, determined by the number of failures and confidence interval
**N** = Total Number of units from HTRB and HTGB tests
**H** = Duration of HTRB/HTGB testing
**Af** = Acceleration Factor from Test to Use Conditions (Ea = 0.7eV and Tuse = 55℃)
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 | 258 | 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, $8.617164 \times 10^{-5}$eV / K