# AON6884

## 40V Dual N-Channel MOSFET

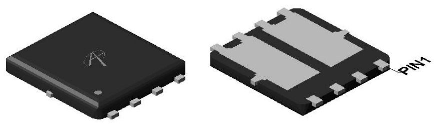
### General Description

The AON6884 uses advanced trench technology to provide excellent $R_{DS(ON)}$ with low gate charge. This is an all purpose device that is suitable for use in a wide range of power conversion applications.

### Product Summary

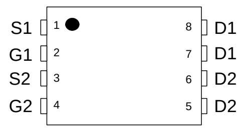
| | |
|---|---|
| $V_{DS}$ | 40V |
| $I_D$ (at $V_{GS}$=10V) | 34A |
| $R_{DS(ON)}$ (at $V_{GS}$=10V) | < 11.3mΩ |
| $R_{DS(ON)}$ (at $V_{GS}$ = 4.5V) | < 13.8mΩ |

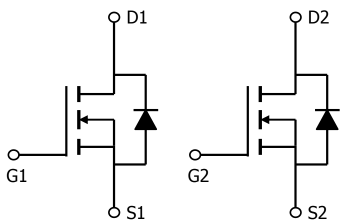
100% UIS Tested
100% $R_g$ Tested




DFN5X6 EP2

**Top View**




| **Absolute Maximum Ratings $T_A$=25°C unless otherwise noted** | | | | |
|---|---|---|---|---|
| **Parameter** | | **Symbol** | **Maximum** | **Units** |
| Drain-Source Voltage | | $V_{DS}$ | 40 | V |
| Gate-Source Voltage | | $V_{GS}$ | ±20 | V |
| Continuous Drain Current | $T_C$=25°C | $I_D$ | 34 | A |
| | $T_C$=100°C | | 21 | |
| Pulsed Drain Current [C] | | $I_{DM}$ | 120 | |
| Continuous Drain Current | $T_A$=25°C | $I_{DSM}$ | 9 | A |
| | $T_A$=70°C | | 7 | |
| Avalanche Current [C] | | $I_{AS}$, $I_{AR}$ | 35 | A |
| Avalanche energy L=0.1mH [C] | | $E_{AS}$, $E_{AR}$ | 61 | mJ |
| Power Dissipation [B] | $T_C$=25°C | $P_D$ | 21 | W |
| | $T_C$=100°C | | 8 | |
| Power Dissipation [A] | $T_A$=25°C | $P_{DSM}$ | 1.6 | W |
| | $T_A$=70°C | | 1 | |
| 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 D] | Steady-State | | 65 | 80 | °C/W |
| Maximum Junction-to-Case | Steady-State | $R_{\theta JC}$ | 5 | 6 | °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 | | 40 | | | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$=40V, $V_{GS}$=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 | | 1.55 | 2.1 | 2.7 | V |
| $I_{D(ON)}$ | On state drain current | $V_{GS}$=10V, $V_{DS}$=5V | | 120 | | | A |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$=10V, $I_D$=10A | | | 9.4 | 11.3 | mΩ |
| | | | $T_J$=125°C | | 14 | 17 | |
| | | $V_{GS}$=4.5V, $I_D$=10A | | | 11 | 13.8 | mΩ |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$=5V, $I_D$=10A | | | 50 | | S |
| $V_{SD}$ | Diode Forward Voltage | $I_S$=1A,$V_{GS}$=0V | | | 0.7 | 1 | V |
| $I_S$ | Maximum Body-Diode Continuous Current | | | | | 25 | A |
| **DYNAMIC PARAMETERS** | | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{GS}$=0V, $V_{DS}$=20V, f=1MHz | | 1200 | 1500 | 1950 | pF |
| $C_{oss}$ | Output Capacitance | | | 150 | 215 | 280 | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 80 | 135 | 190 | pF |
| $R_g$ | Gate resistance | $V_{GS}$=0V, $V_{DS}$=0V, f=1MHz | | 1.7 | 3.5 | 5.3 | Ω |
| **SWITCHING PARAMETERS** | | | | | | | |
| $Q_g$(10V) | Total Gate Charge | $V_{GS}$=10V, $V_{DS}$=20V, $I_D$=10A | | 22 | 27.2 | 33 | nC |
| $Q_g$(4.5V) | Total Gate Charge | | | 10 | 13.6 | 16 | nC |
| $Q_{gs}$ | Gate Source Charge | | | 3.6 | 4.5 | 5.4 | nC |
| $Q_{gd}$ | Gate Drain Charge | | | 3.8 | 6.4 | 9 | nC |
| $t_{D(on)}$ | Turn-On DelayTime | $V_{GS}$=10V, $V_{DS}$=20V, $R_L$=2Ω, $R_{GEN}$=3Ω | | | 6.4 | | ns |
| $t_r$ | Turn-On Rise Time | | | | 17.2 | | ns |
| $t_{D(off)}$ | Turn-Off DelayTime | | | | 29.6 | | ns |
| $t_f$ | Turn-Off Fall Time | | | | 16.8 | | ns |
| $t_{rr}$ | Body Diode Reverse Recovery Time | $I_F$=10A, dI/dt=500A/µs | | 9 | 13 | 17 | ns |
| $Q_{rr}$ | Body Diode Reverse Recovery Charge | $I_F$=10A, dI/dt=500A/µs | | 25 | 35 | 45 | 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.

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. Repetitive rating, pulse width limited by junction temperature $T_{J(MAX)}$=150°C. Ratings are based on low frequency and duty cycles to keep initial $T_J$ =25°C.

D. The $R_{\theta JA}$ is the sum of the thermal impedence 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 impedence 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 ratin g.

G. The maximum current rating is limited by bond-wires.

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.

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

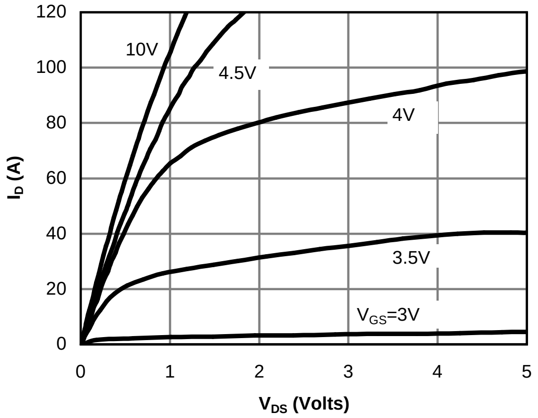



Fig 1: On-Region Characteristics (Note E)

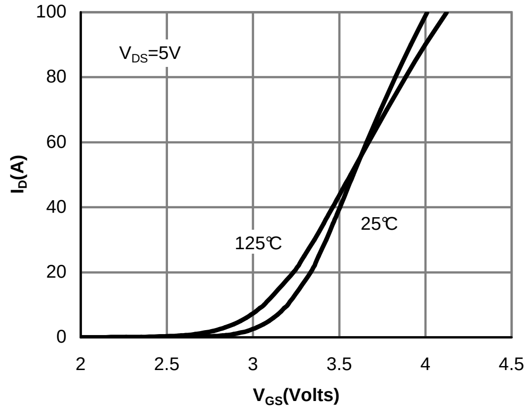



Figure 2: Transfer Characteristics (Note E)

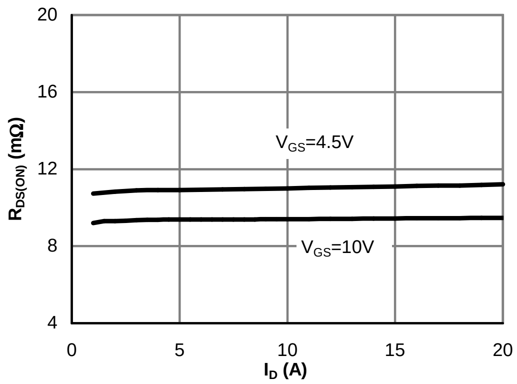



Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

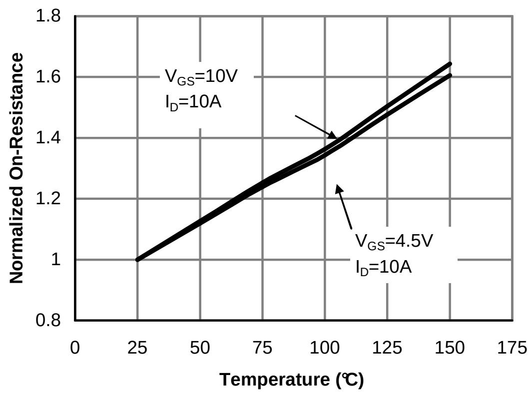



Figure 4: On-Resistance vs. Junction Temperature (Note E)

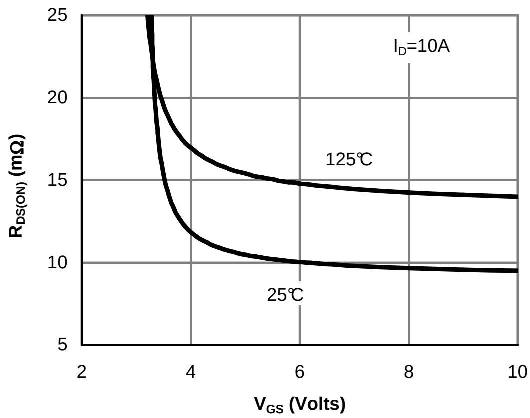



Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

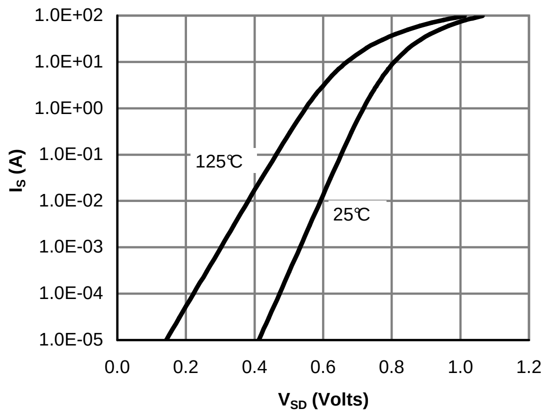



Figure 6: Body-Diode Characteristics (Note E)

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

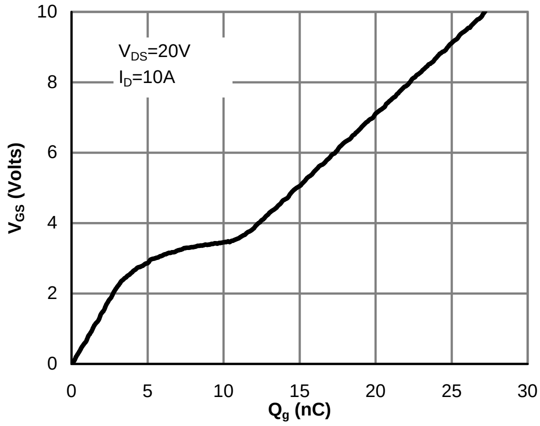



Figure 7: Gate-Charge Characteristics

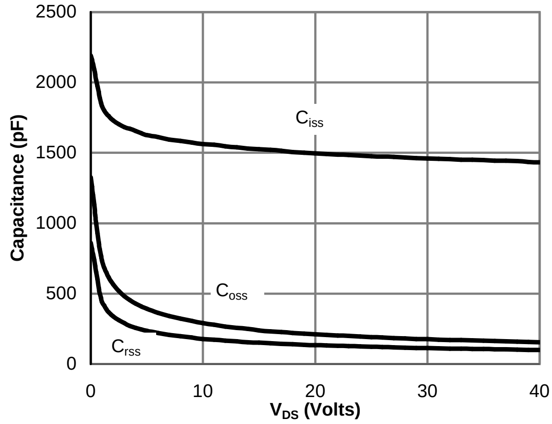



Figure 8: Capacitance Characteristics

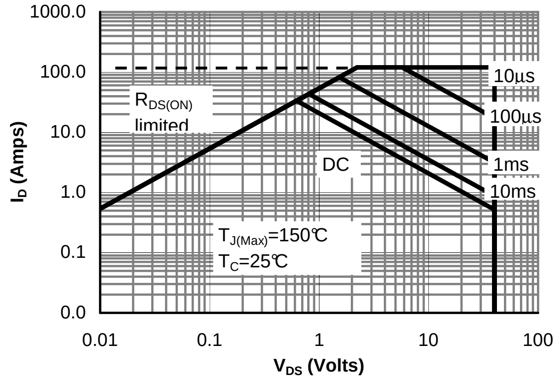



Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

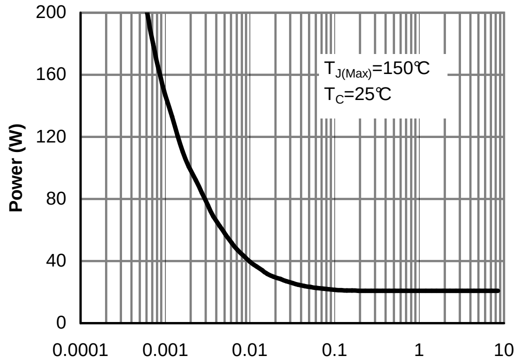



Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

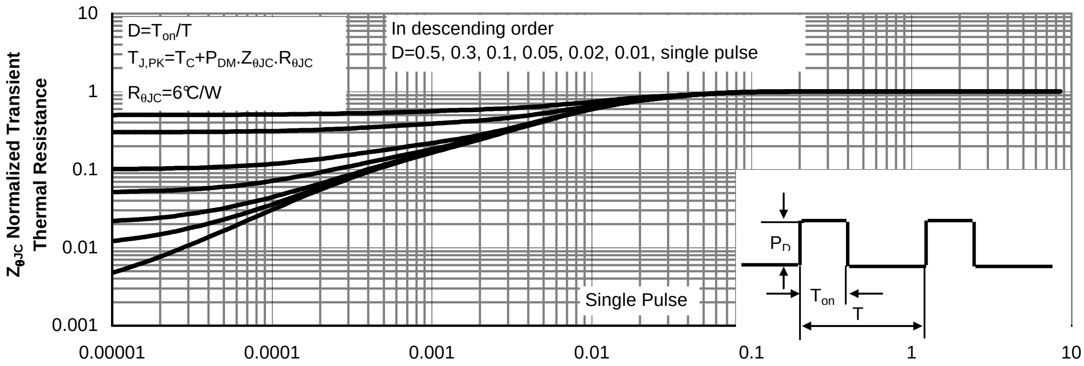



Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

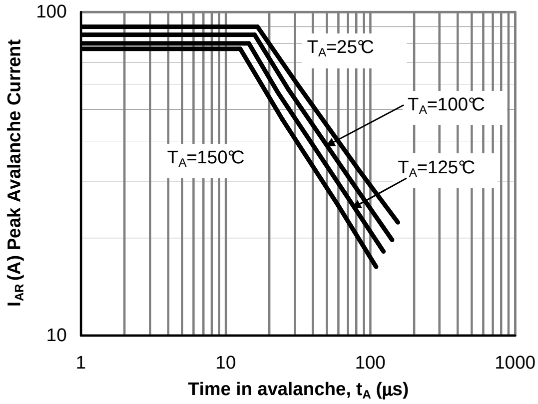



Figure 12: Single Pulse Avalanche capability (Note C)

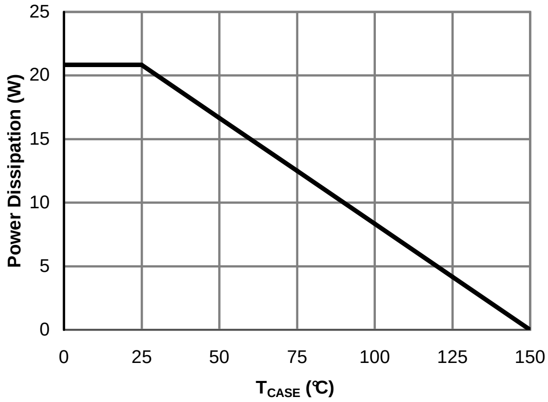



Figure 13: Power De-rating (Note F)

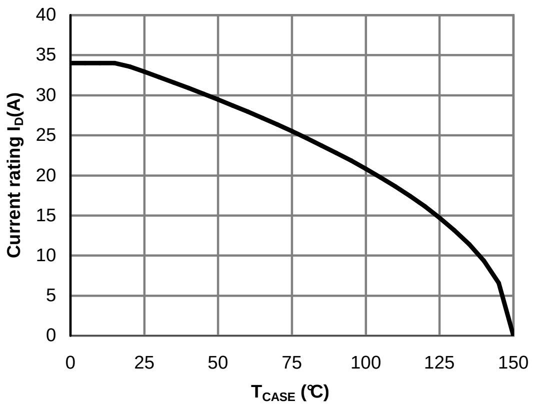



Figure 14: Current De-rating (Note F)

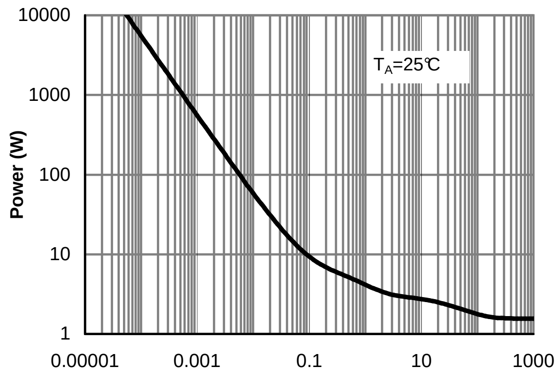



Figure 15: Single Pulse Power Rating Junction-to-Ambient (Note H)

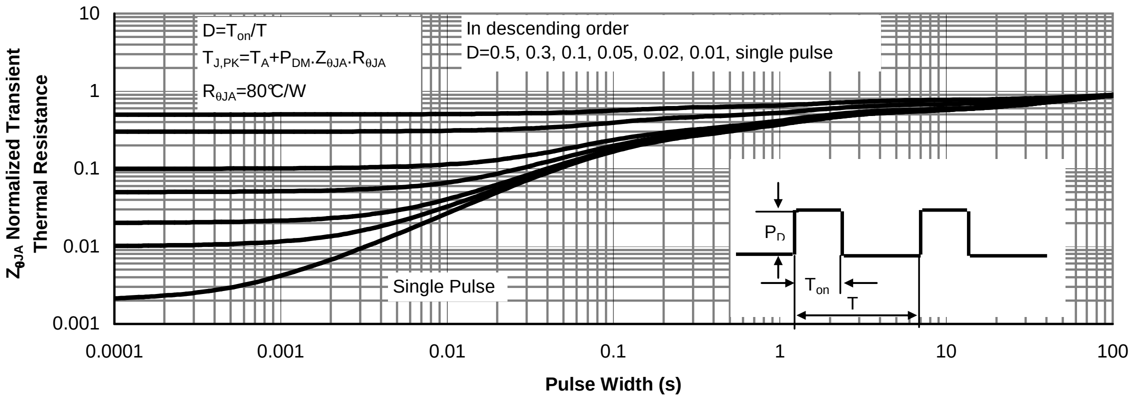
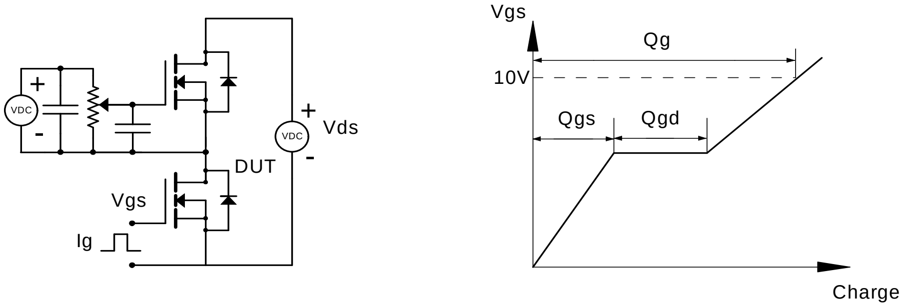
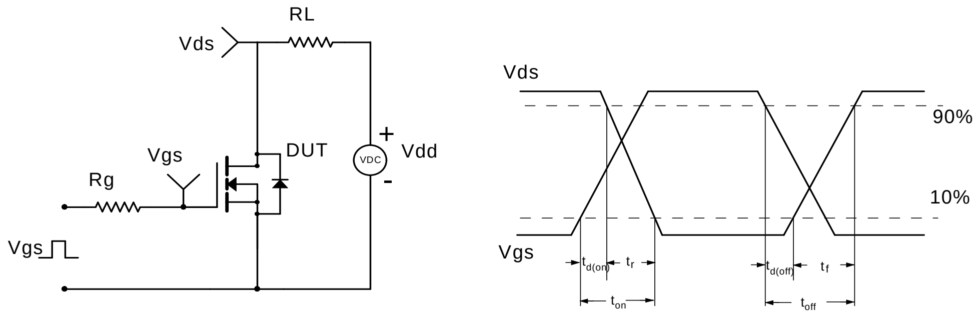



Figure 16: Normalized Maximum Transient Thermal Impedance (Note H)

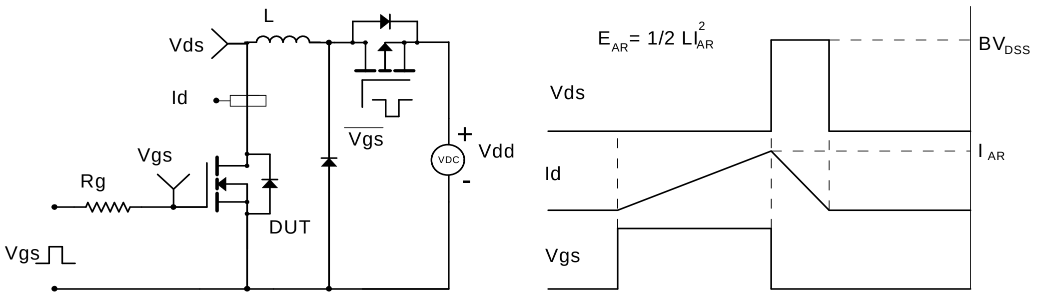
## Gate Charge Test Circuit & Waveform



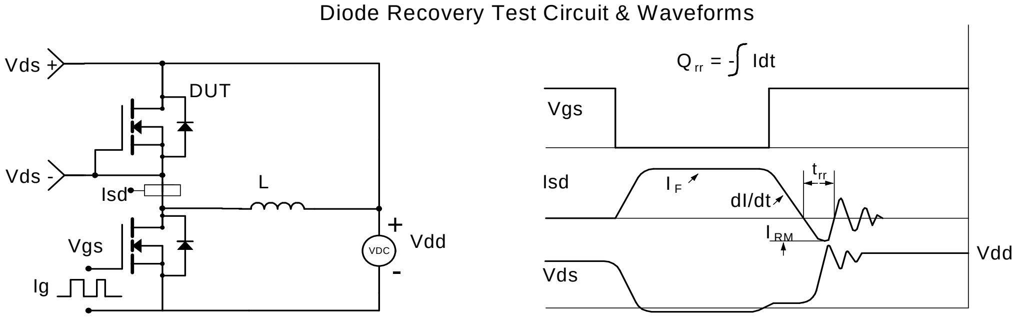

## Resistive Switching Test Circuit & Waveforms




## Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



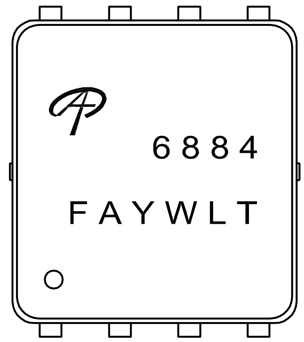

## Diode Recovery Test Circuit & Waveforms



ALPHA & OMEGA
SEMICONDUCTOR

| Document No. | PD-01083 |
| --- | --- |
| Version | B |
| Title | AON6884 Marking Description |

## DFN5X6 PACKAGE MARKING DESCRIPTION



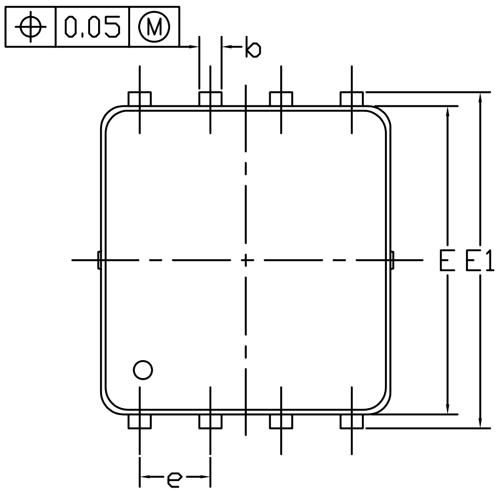

Green product

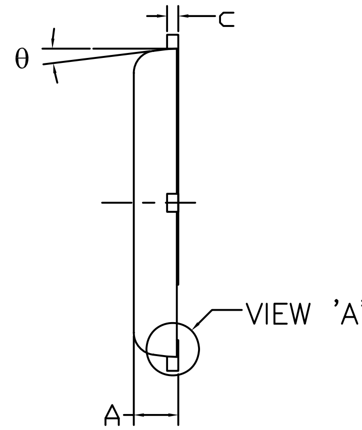
NOTE:
LOGO - AOS Logo
6884 - Part number code
F - Fab code
A - Assembly location code
Y - Year code
W - Week code
L&T - Assembly lot code

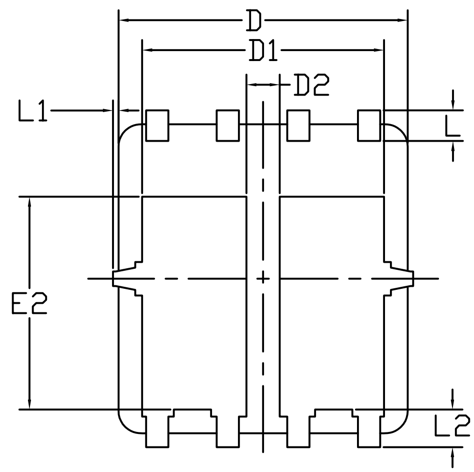
| PART NO. | DESCRIPTION | CODE |
| --- | --- | --- |
| AON6884 | Green product | 6884 |
| AON6884L | Green product | 6884 |

| Document No. | PO-00045 |
|---|---|
| Version | rev B |

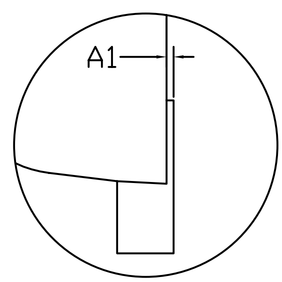
# DFN5x6_8L_EP2_P PACKAGE OUTLINE



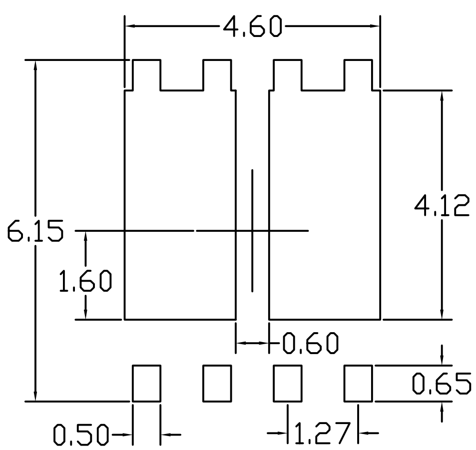




BOTTOM VIEW




VIEW 'A'
(SCALE 5:1)

RECOMMENDED LAND PATTERN




UNIT: mm

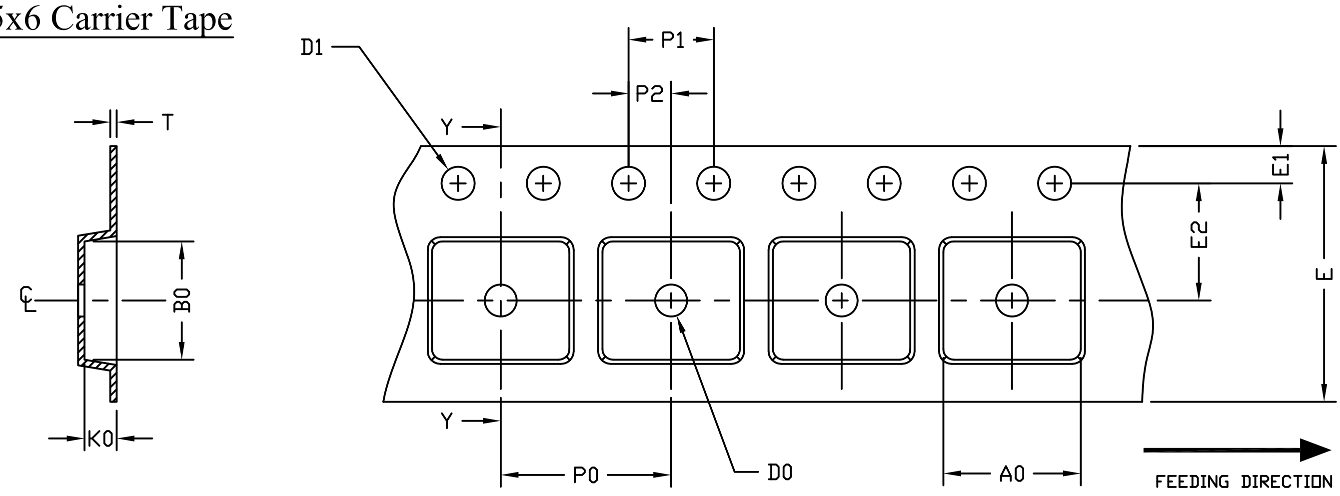
| SYMBOLS | DIMENSIONS IN MILLIMETERS | | | DIMENSIONS IN INCHES | | |
|---|---|---|---|---|---|---|
| | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 0.85 | 0.95 | 1.00 | 0.033 | 0.037 | 0.039 |
| A1 | 0.00 | --- | 0.05 | 0.000 | --- | 0.002 |
| b | 0.30 | 0.40 | 0.50 | 0.012 | 0.016 | 0.020 |
| c | 0.15 | 0.20 | 0.25 | 0.006 | 0.008 | 0.010 |
| D | 5.20 BSC | | | 0.205 BSC | | |
| D1 | 4.35 BSC | | | 0.171 BSC | | |
| D2 | 0.50 | 0.60 | 0.75 | 0.020 | 0.024 | 0.030 |
| E | 5.55 BSC | | | 0.219 BSC | | |
| E1 | 6.05 BSC | | | 0.238 BSC | | |
| E2 | 3.82 BSC | | | 0.150 BSC | | |
| 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.

ALPHA & OMEGA SEMICONDUCTOR

# DFN5x6 Tape and Reel Data

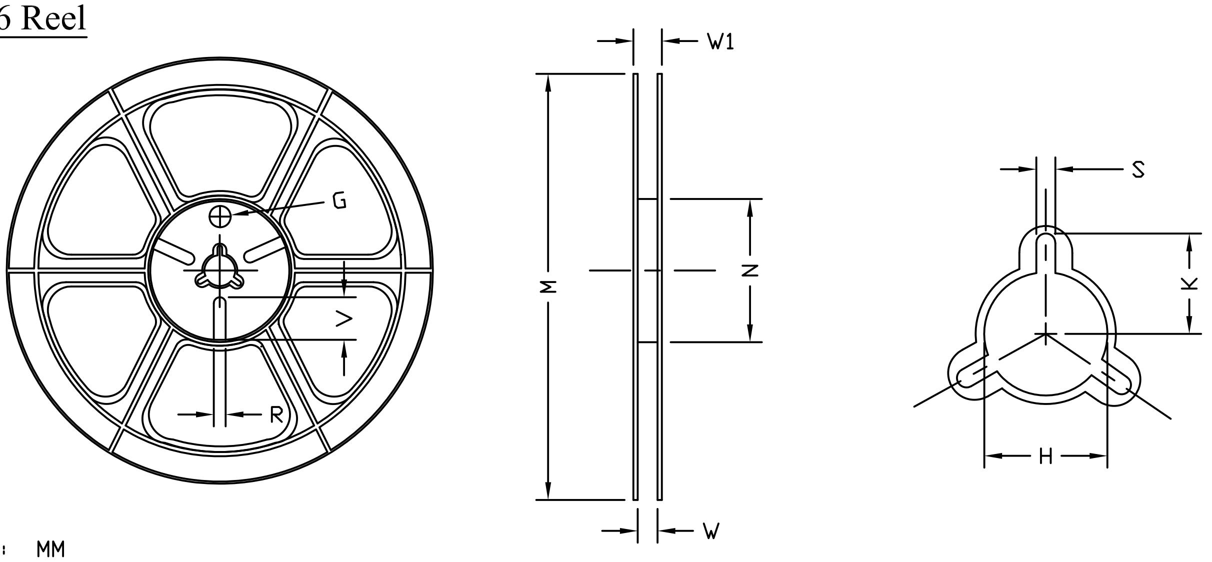
## DFN5x6 Carrier Tape




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



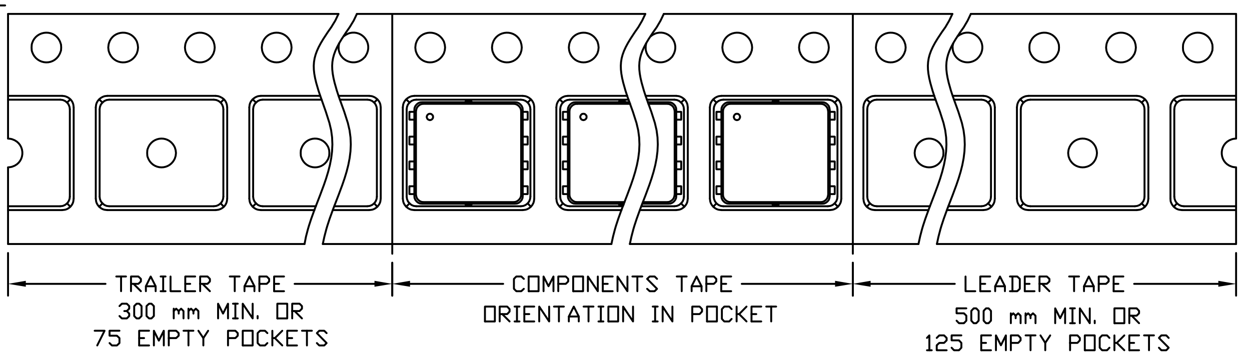

UNIT: MM

| 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



# AOS Semiconductor
# Product Reliability Report

## AON6884, rev B

**Plastic Encapsulated Device**

**ALPHA & OMEGA Semiconductor, Inc**

**www.aosmd.com**

This AOS product reliability report summarizes the qualification result for AON6884. 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 AON6884 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.

## Table of Contents:



## I. Product Description:

The AON6884 uses advanced trench technology to provide excellent $R_{DS(ON)}$ with low gate charge. This is an all purpose device that is suitable for use in a wide range of power conversion applications

Details refer to the datasheet.

## II. Die / Package Information:

| | **AON6884** |
|---|---|
| **Process** | Standard sub-micron<br>40V Dual N-Channel MOSFET |
| **Package Type** | DFN5x6 EP2 |
| **Lead Frame** | Bare Cu |
| **Die Attach** | Ag Epoxy |
| **Bond** | Au Wire |
| **Mold Material** | Epoxy resin with silica filler |
| **Moisture Level** | Up to Level 1 |

## III. 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 | 924 pcs | 0 | JESD22-A108 |
| HTRB | Temp = 150°C , Vds=80% of Vdsmax | 168 / 500 / 1000 hours | 924 pcs | 0 | JESD22-A108 |
| MSL Precondition | 168hr 85°C / 85%RH + 3 cycle reflow@260°C (MSL 1) | - | 2772 pcs | 0 | JESD22-A113 |
| HAST | 130°C , 85%RH, 33.3 psi, Vds = 80% of Vdsmax | 96 hours | 924 pcs | 0 | JESD22-A110 |
| Autoclave | 121°C , 29.7psi, RH=100% | 96 hours | 924 pcs | 0 | JESD22-A102 |
| Temperature Cycle | -65°C to 150°C , air to air, | 250 / 500 cycles | 924 pcs | 0 | JESD22-A104 |

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

## IV. Reliability Evaluation

### FIT rate (per billion): 3.27
### MTTF = 34926 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)**] =** 3.27
**MTTF =** $10^9$ / FIT = 34926 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