ALPHA & OMEGA SEMICONDUCTOR

# AONS66923

## 100V N-Channel AlphaSGT™

### General Description

- Trench Power AlphaSGT™ technology
- Low $R_{DS(ON)}$
- Logic Level Driving
- Excellent $Q_G$ x $R_{DS(ON)}$ Product (FOM)
- Spike Optimized Process
- RoHS and Halogen-Free Compliant

### Applications

- High Frequency Switching and Synchronous Rectification

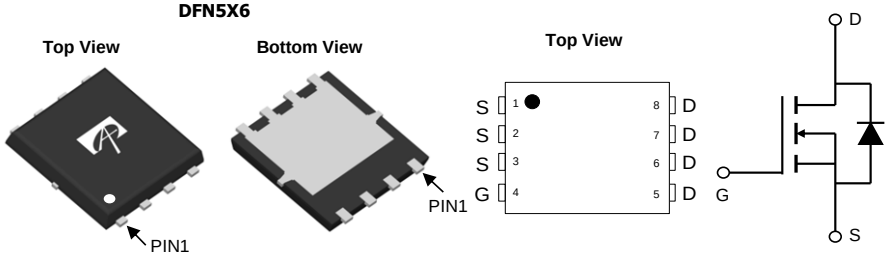
### Product Summary

| | |
|---|---|
| $V_{DS}$ | 100V |
| $I_D$ (at $V_{GS}$=10V) | 47A |
| $R_{DS(ON)}$ (at $V_{GS}$=10V) | < 10.8mΩ |
| $R_{DS(ON)}$ (at $V_{GS}$=4.5V) | < 14.8mΩ |

100% UIS Tested
100% Rg Tested

Green Product

**DFN5X6**




| Orderable Part Number | Package Type | Form | Minimum Order Quantity |
|---|---|---|---|
| AONS66923 | DFN 5x6 | Tape & Reel | 3000 |

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

| Parameter | | Symbol | Maximum | Units |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | 100 | V |
| Gate-Source Voltage | | $V_{GS}$ | ±20 | V |
| Continuous Drain Current | $T_C$=25°C | $I_D$ | 47 | A |
| | $T_C$=100°C | | 30 | |
| Pulsed Drain Current [C] | | $I_{DM}$ | 105 | |
| Continuous Drain Current | $T_A$=25°C | $I_{DSM}$ | 15 | A |
| | $T_A$=70°C | | 12 | |
| Avalanche Current [C] | | $I_{AS}$ | 30 | A |
| Avalanche energy | L=0.1mH [C] | $E_{AS}$ | 45 | mJ |
| Power Dissipation [B] | $T_C$=25°C | $P_D$ | 48 | W |
| | $T_C$=100°C | | 19 | |
| Power Dissipation [A] | $T_A$=25°C | $P_{DSM}$ | 5.0 | 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 | $R_{\theta JC}$ | 2.1 | 2.6 | °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 | 100 | | | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$=100V, $V_{GS}$=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 | 1.6 | 2.1 | 2.6 | V |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$=10V, $I_D$=20A | | 9.0 | 10.8 | mΩ |
| | | $T_J$=125°C | | 15.8 | 19.3 | |
| | | $V_{GS}$=4.5V, $I_D$=20A | | 11.5 | 14.8 | mΩ |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$=5V, $I_D$=20A | | 50 | | S |
| $V_{SD}$ | Diode Forward Voltage | $I_S$=1A, $V_{GS}$=0V | | 0.72 | 1 | V |
| $I_S$ | Maximum Body-Diode Continuous Current | | | | 47 | A |
| **DYNAMIC PARAMETERS** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{GS}$=0V, $V_{DS}$=50V, f=1MHz | | 1725 | | pF |
| $C_{oss}$ | Output Capacitance | | | 360 | | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 7.5 | | pF |
| $R_g$ | Gate resistance | f=1MHz | 0.3 | 0.8 | 1.3 | Ω |
| **SWITCHING PARAMETERS** | | | | | | |
| $Q_{g(10V)}$ | Total Gate Charge | $V_{GS}$=10V, $V_{DS}$=50V, $I_D$=20A | | 25 | 35 | nC |
| $Q_{g(4.5V)}$ | Total Gate Charge | | | 12.5 | 18 | nC |
| $Q_{gs}$ | Gate Source Charge | | | 6 | | nC |
| $Q_{gd}$ | Gate Drain Charge | | | 3.5 | | nC |
| $Q_{oss}$ | Output Charge | $V_{GS}$=0V, $V_{DS}$=50V | | 30 | | nC |
| $t_{D(on)}$ | Turn-On DelayTime | $V_{GS}$=10V, $V_{DS}$=50V, $R_L$=2.5Ω, $R_{GEN}$=3Ω | | 8.5 | | ns |
| $t_r$ | Turn-On Rise Time | | | 3 | | ns |
| $t_{D(off)}$ | Turn-Off DelayTime | | | 23 | | ns |
| $t_f$ | Turn-Off Fall Time | | | 3.5 | | ns |
| $t_{rr}$ | Body Diode Reverse Recovery Time | $I_F$=20A, di/dt=500A/µs | | 41 | | ns |
| $Q_{rr}$ | Body Diode Reverse Recovery Charge | $I_F$=20A, di/dt=500A/µs | | 156 | | 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

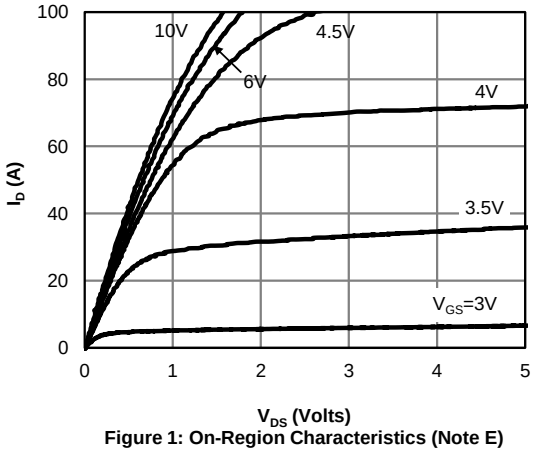



**Figure 1: On-Region Characteristics (Note E)**

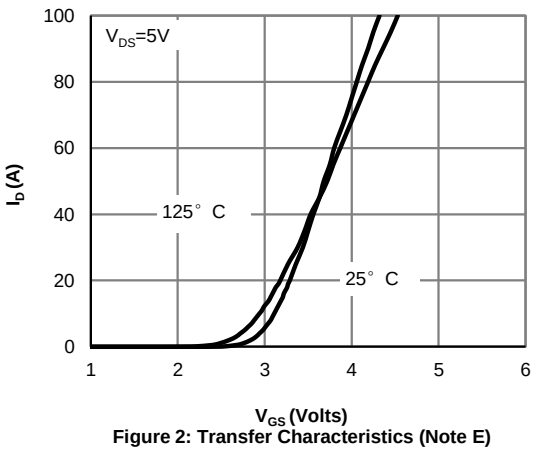



**Figure 2: Transfer Characteristics (Note E)**

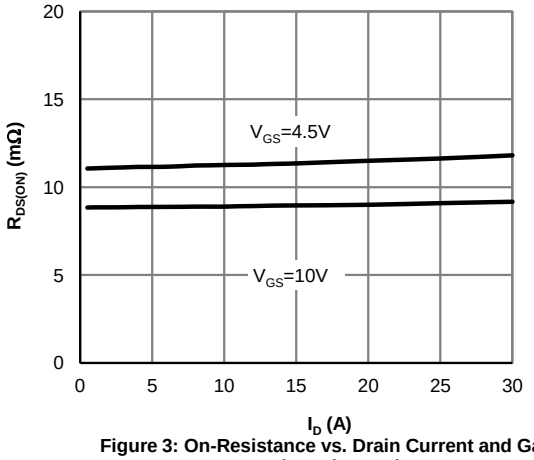



**Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)**

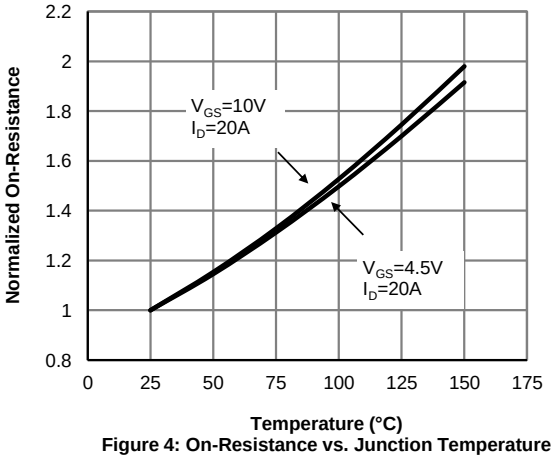



**Figure 4: On-Resistance vs. Junction Temperature (Note E)**

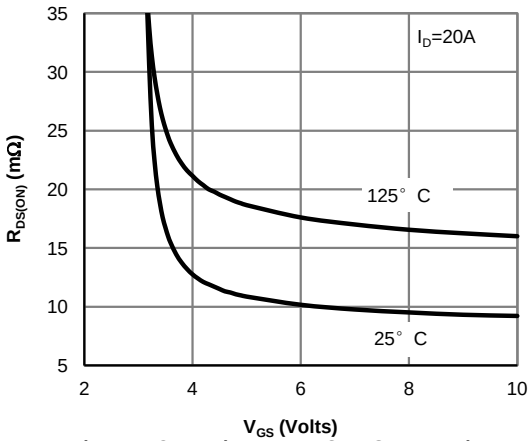



**Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)**

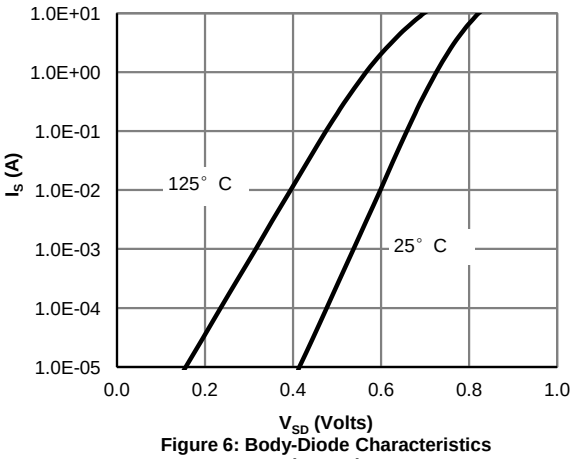



**Figure 6: Body-Diode Characteristics (Note E)**

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

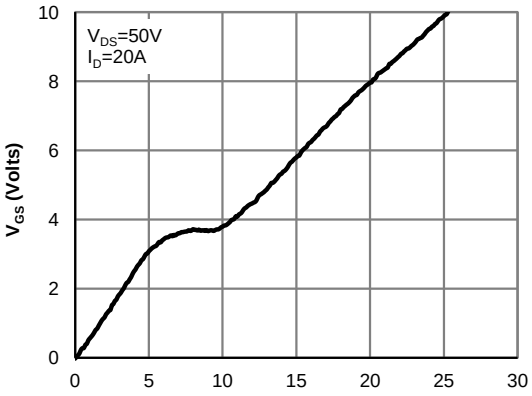



**Figure 7: Gate-Charge Characteristics**

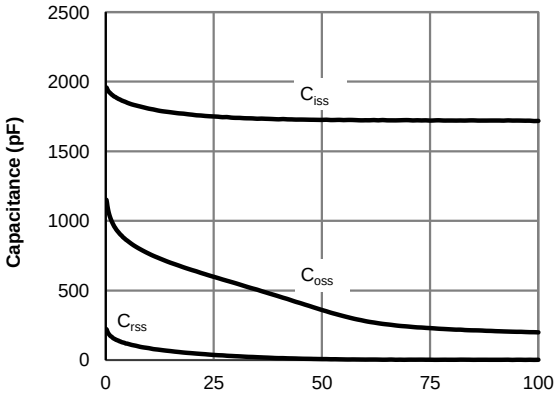



**Figure 8: Capacitance Characteristics**

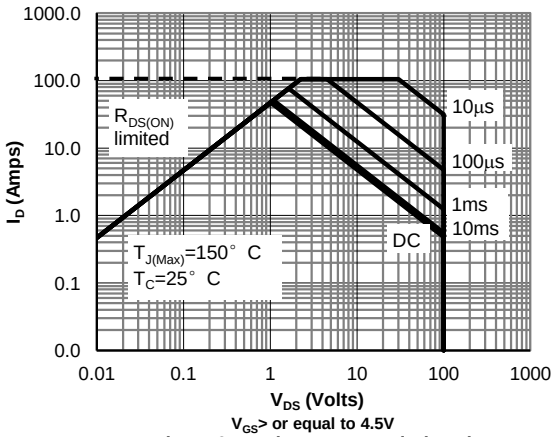



**Figure 9: Maximum Forward Biased Safe Operating Area (Note F)**

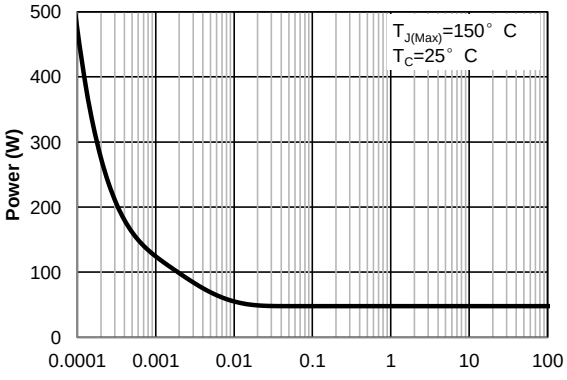



**Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)**

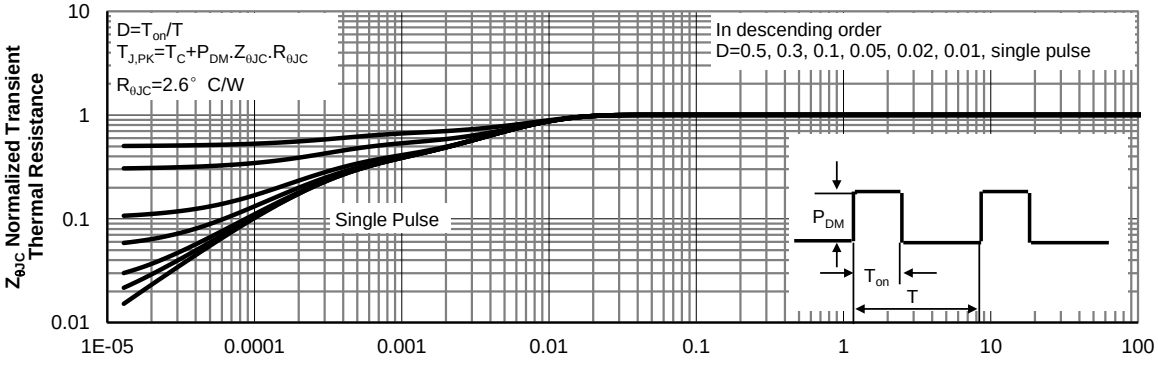



**Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)**

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

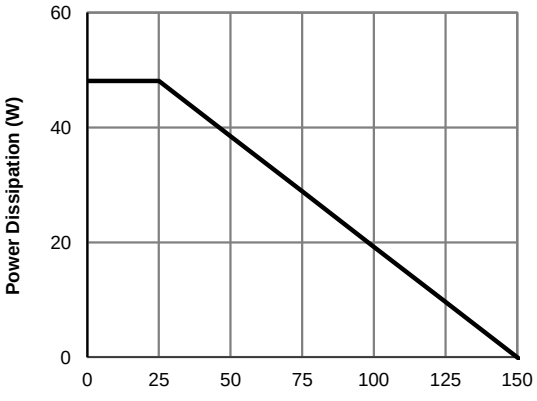



**Figure 12: Power De-rating (Note F)**

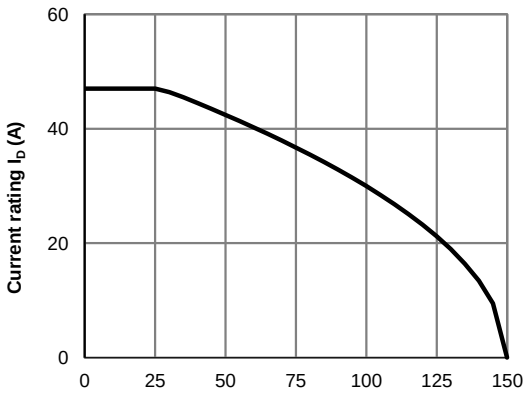



**Figure 13: Current De-rating (Note F)**

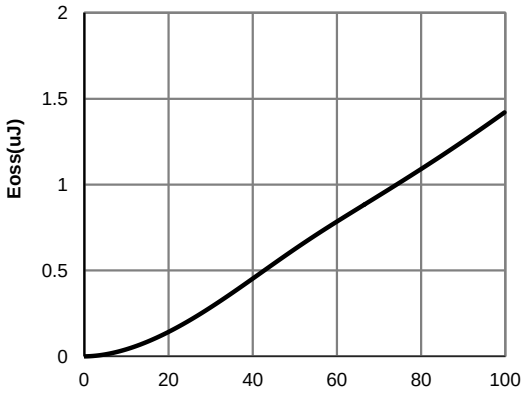



**Figure 14: Coss stored Energy**

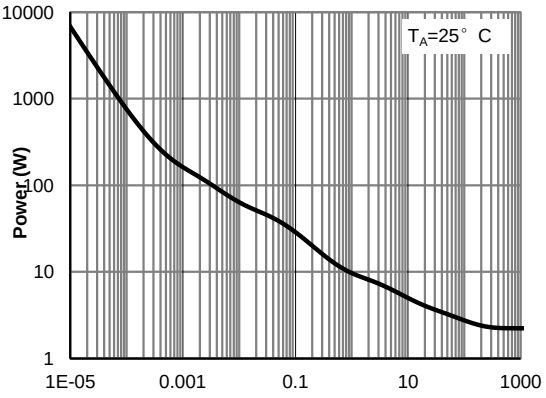



**Figure 15: Single Pulse Power Rating Junction-to-Ambient (Note H)**

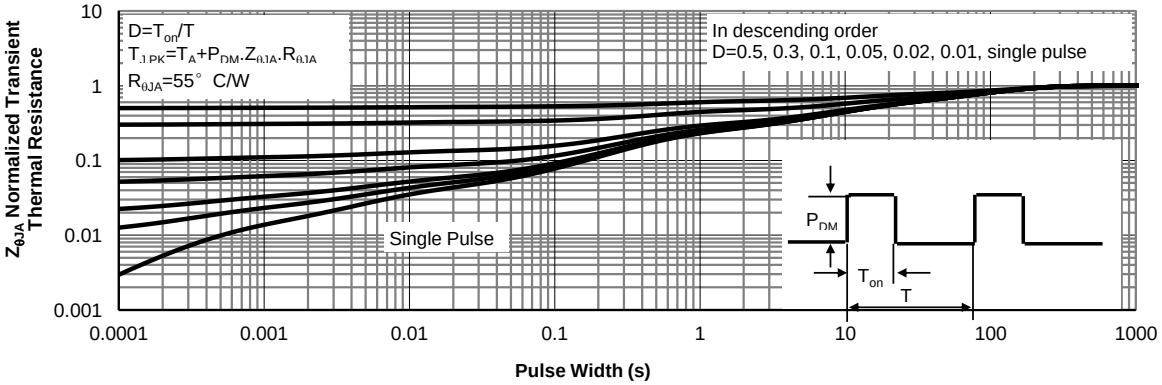



**Figure 16: Normalized Maximum Transient Thermal Impedance (Note H)**

Figure A: Gate Charge Test Circuit & Waveforms

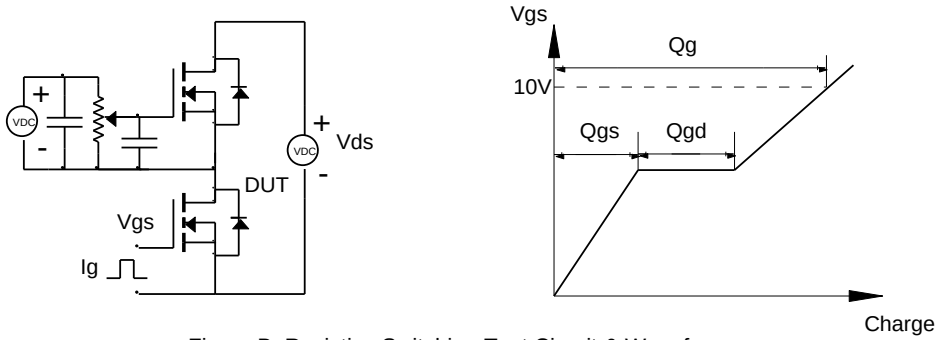



Figure B: Resistive Switching Test Circuit & Waveforms

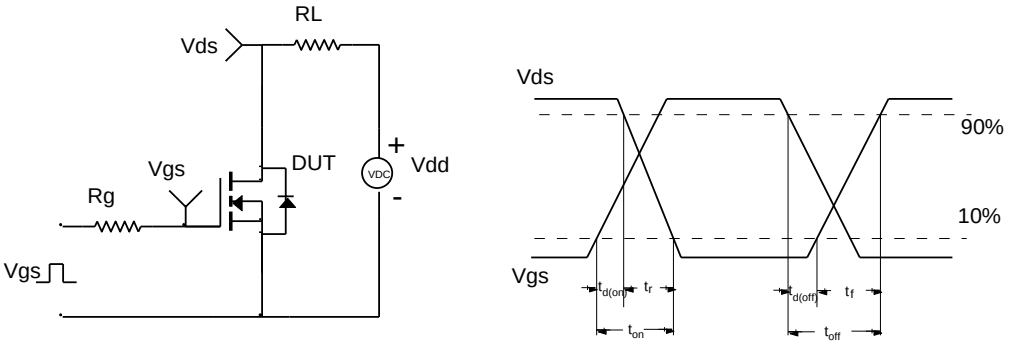



Figure C: Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

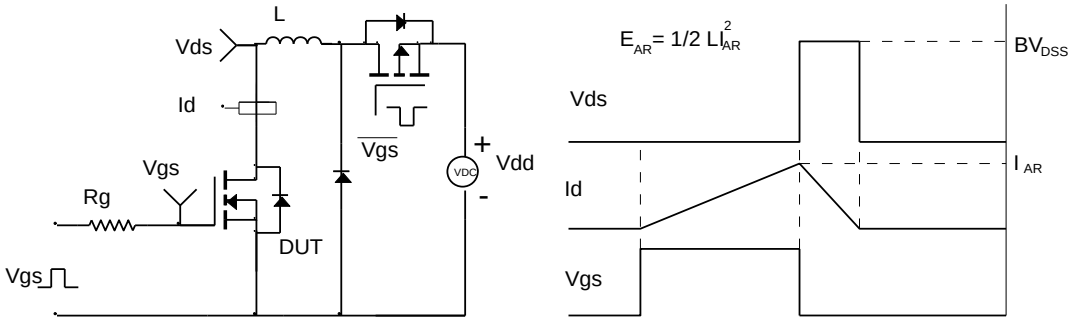
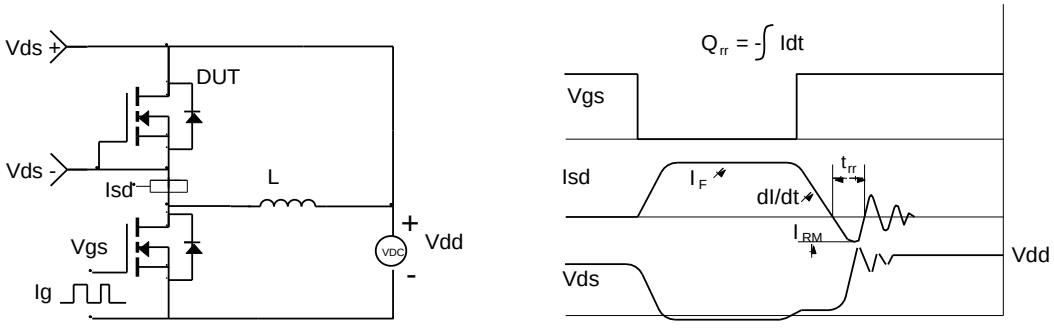


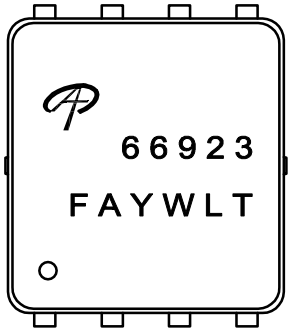

Figure D: Diode Recovery Test Circuit & Waveforms



**ALPHA & OMEGA SEMICONDUCTOR**

| Document No. | PD-02930 |
|---|---|
| Version | A |
| Title | AONS66923 Marking Description |

DFN5x6 PACKAGE MARKING DESCRIPTION




Green product

NOTE:

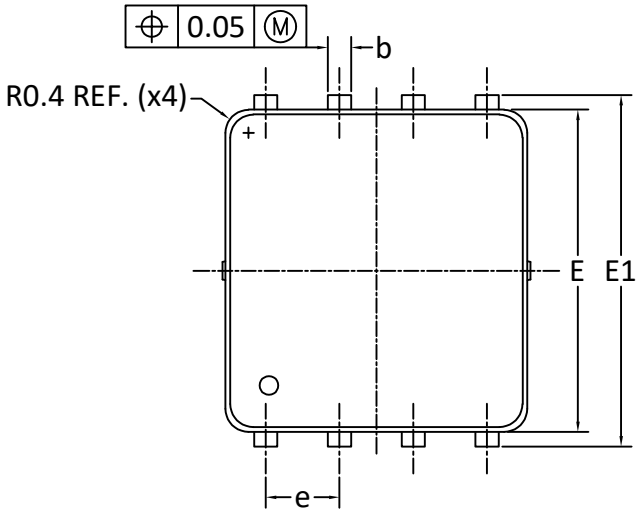
| | |
|---|---|
| LOGO | - AOS Logo |
| 66923 | - Part number code |
| F | - Fab code |
| A | - Assembly location code |
| Y | - Year code |
| W | - Week code |
| L&T | - Assembly lot code |

| PART NO. | DESCRIPTION | CODE |
|---|---|---|
| AONS66923 | Green product | 66923 |

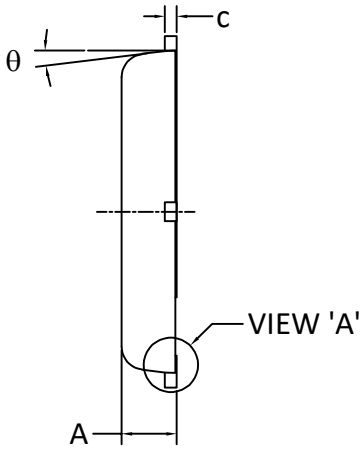
ALPHA & OMEGA SEMICONDUCTOR

| Document No. | PO-00044 |
|---|---|
| Version | I |

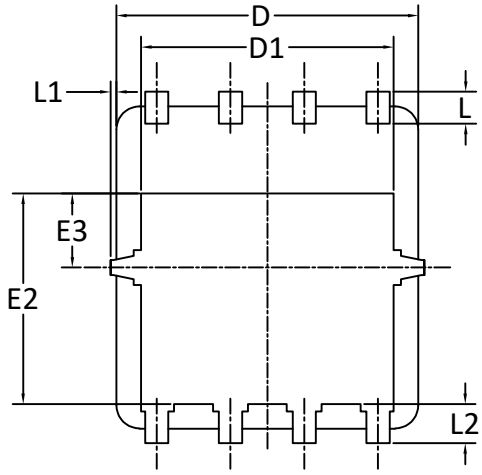
# DFN5x6_8L_EP1_P PACKAGE OUTLINE



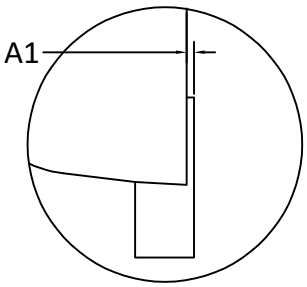

TOP VIEW




SIDE VIEW

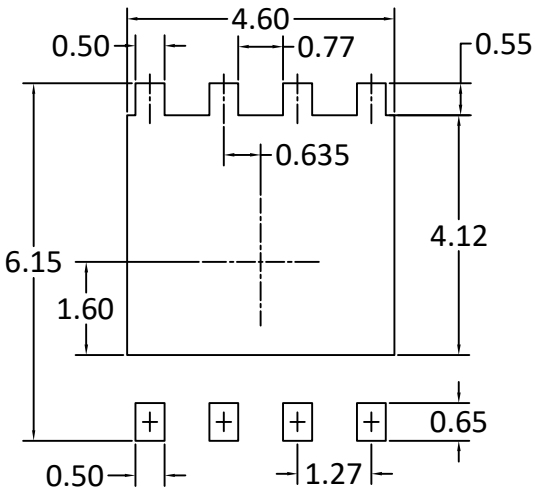



BOTTOM VIEW




VIEW 'A'
(SCALE 5:1)

## RECOMMENDED LAND PATTERN




UNIT: mm

| SYMBOLS | DIMENSION IN MM | | | DIMENSION 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 | 0.00 | - | 0.15 | 0.000 | - | 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.
3. THIS PACKAGE WAS QUALIFIED USING IR REFLOW PROCESS (JEDEC STANDARD). FOR USAGE IN OTHER SOLDERING PROCESSES, PLEASE CONTACT LOCAL AOS REPRESENTATIVES.

ALPHA & OMEGA SEMICONDUCTOR

# *AOS Semiconductor*
# *Product Reliability Report*

## AONS66923, rev A

**Plastic Encapsulated Device**

**ALPHA & OMEGA Semiconductor, Inc**

**www.aosmd.com**

May, 2018

ALPHA & OMEGA SEMICONDUCTOR

This AOS product reliability report summarizes the qualification result for AONS66923. 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 AONS66923 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 | 231 pcs | 0 | JESD22-A108 |
| HTRB | Temp = 150°C , Vds=100% of Vdsmax | 168 / 500 / 1000 hours | 231 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 up to 42V | 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 | ∆ Tj = 100°C | 15000 cycles | 693 pcs | 0 | AEC Q101 |

**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): 7.63
## MTTF = 14960 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.

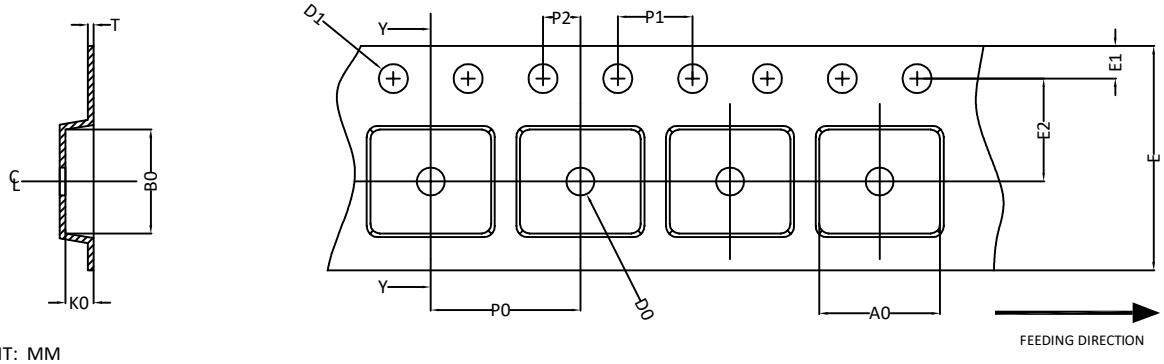
**Failure Rate** = $Chi^2 \times 10^9$ **/ [**2 (N) (H) (Af)**] =** 7.63
**MTTF =** $10^9$ / FIT = 14960 years
**Chi²** = Chi Squared Distribution, determined by the number of failures and confidence interval
**N** = Total Number of units from burn-in tests
**H** = Duration of burn-in testing
**Af** = 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 Tape and Reel Data

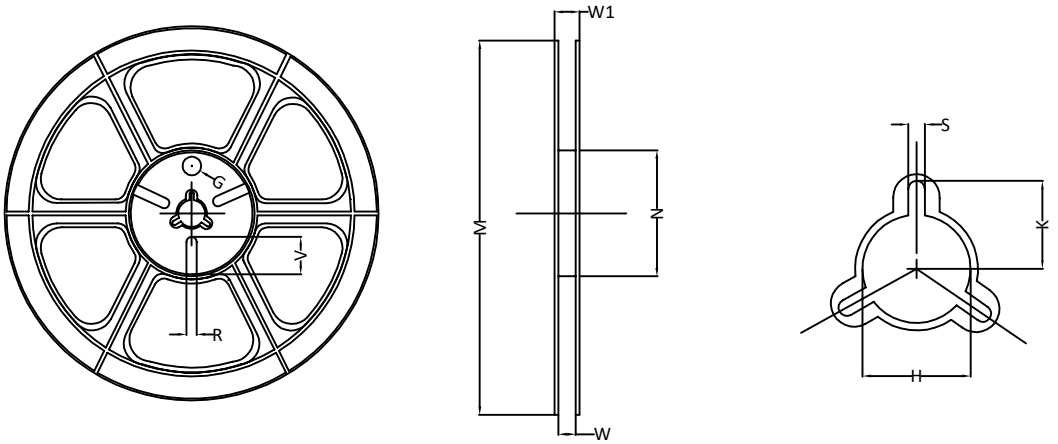
## DFN5x6 Carrier Tape




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



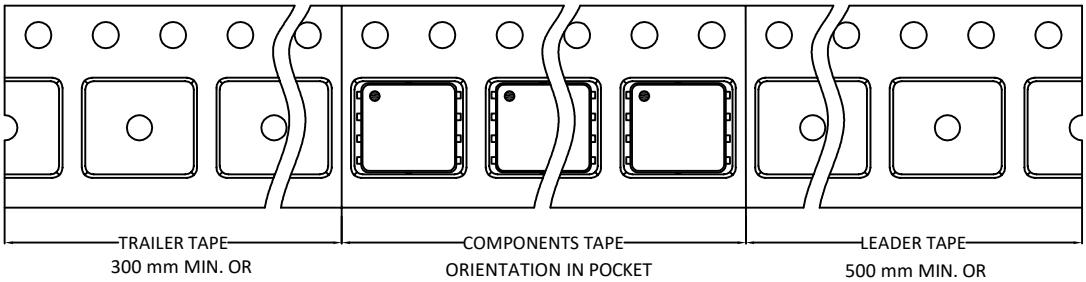

UNIT: MM

| 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 Punch Package Tape

Leader / Trailer & Orientation

Unit Per Reel: 3000pcs




## DFN5x6_Sawing Package (Except DFN5x6_7L_EP1_TEP1_S/DFN5x6_2L_EP3_TEP1_S /DFN5x6_8L_EP1_TEP1_S/DFN5x6_8L_EP1_TEP2_S/DFN5x6_8L_EP2_TEP1_S/ DFN5x6A_8L_EP2_TEP1_S) Tape

Leader / Trailer & Orientation

Unit Per Reel: 3000pcs