# AONV070V65G1

## 650V Enhancement Mode GaN Transistor

### Features

- 650V Enhancement Mode GaN Transistor
- Normal-off Design
- Ultra-low Qg
- No Qrr
- Low Inductance

### Applications

- Server Power Supplies
- High-Frequency Converters
- Resonant Topologies

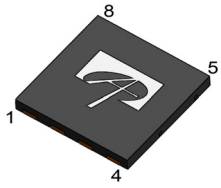
### Product Summary

| | |
|---|---|
| $V_{DS}$ @ $T_J$, max | 650V |
| $I_{DM}$ | 45A |
| $R_{DS(ON)}$ | 70mΩ |
| $Q_{g,}$ typ | 6.9nC |
| $E_{oss}$ @ 400V | 6µJ |

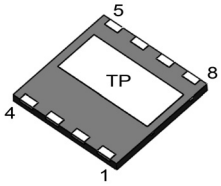
Green Product

### Pin Configuration and Pin Names

**DFN 8x8**

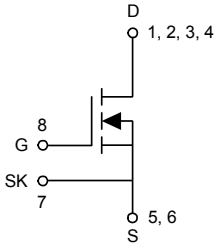



Top View




Bottom View

| Pin Names | |
|---|---|
| Gate | 8 |
| Drain | 1, 2, 3, 4 |
| Kelvin Source | 7 |
| Source | 5, 6 |
| Thermal Pad (Connected to Source) | TP |




### Absolute Maximum Ratings

Exceeding the Absolute Maximum Ratings may damage the device. $T_A$ = 25°C, unless otherwise stated.

| Symbol | Parameter | | Maximum | Units |
|---|---|---|---|---|
| $V_{DS}$ | Drain-Source Voltage | | 650 (DC)<br>720 (AC) | V |
| $V_{GS}$ | Gate-Source Voltage | | +6 / -4 (DC)<br>+10 / -10 (AC) | V |
| $I_D$ | Continuous Drain Current | $T_A$ = 25°C<br>$T_A$ = 100°C | 16[1]<br>12[1] | A |
| $P_D$ | Power Dissipation[2] | Derate above 25°C | 125 | W |
| $T_J$, $T_{STG}$ | Junction and Storage Temperature Range | | -55 to 150 | °C |
| $T_L$ | Maximum Lead and Temperature for Soldering | | 260 | °C |

### Thermal Characteristics

| Symbol | Parameter | Maximum | Units |
|---|---|---|---|
| $R_{JC\theta}$ | Maximum Junction-to-Case | 1 | °C/W |
| $R_{JA\theta}$ | Maximum Junction-to-Ambient[3] | 65 | °C/W |

## Electrical Characteristics

$T_A$ = 25 °C, $V_{IN}$ = V, unless otherwise specified.

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **STATIC** | | | | | | |
| $V_{DS(max)}$ | Drain-Source Voltage | DC static $V_{DS}$(max) | | | 650 | V |
| | | AC transient $_{VDS}$(max) | | | 720 | |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$=650V, $V_{GS}$=0V | | 0.5 | | µA |
| | | $T_J$=150°C | | 5 | | |
| $I_{GSS}$ | Gate-Source Leakage Current | $V_{DS}$=0V, $V_{GS}$=6V | | 100 | | µA |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$=5V, $I_D$=5mA | 1.1 | 1.8 | 2.3 | V |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$=6V, $I_D$=6A | | 70 | 90 | mΩ |
| | | $T_J$ = 150°C | | 165 | | |
| $V_{SD}$ | Diode Forward Voltage | $I_S$=10A,$V_{GS}$=0V | | 2.3 | | V |
| **DYNAMIC** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{GS}$=0V, $V_{DS}$=400V, f=1MHz | | 203 | | pF |
| $C_{oss}$ | Output Capacitance | | | 58 | | pF |
| $C_{o(er)}$ | Effective Output Capacitance, Energy Related[4] | $V_{GS}$=0V, $V_{DS}$=0 to 400V, f=1MHz | | 74 | | pF |
| $C_{o(tr)}$ | Effective Output Capacitance, Time Related[5] | | | 105 | | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | $V_{GS}$=0V, $V_{DS}$=400V, f=1MHz | | 1.5 | | pF |
| $R_g$ | Gate Resistance | f=1MHz | | 10 | | Ω |
| **SWITCHING** | | | | | | |
| $Q_g$ | Total Gate Charge | $V_{GS}$=6V, $V_{DS}$=400V, $I_D$=6A | | 6.9 | | nC |
| $Q_{gs}$ | Gate Source Charge | | | 2 | | nC |
| $Q_{gd}$ | Gate Drain Charge | | | 1.4 | | nC |
| $t_{D(on)}$ | Turn-On DelayTime | $V_{GS}$=-3V/+6V, $V_{DS}$=400V, $I_D$=6A, $R_{G,ON}$=4.7Ω, $R_{G,OFF}$=1Ω | | 2.4 | | ns |
| $t_r$ | Turn-On Rise Time | | | 5.4 | | ns |
| $t_{D(off)}$ | Turn-Off DelayTime | | | 6.2 | | ns |
| $t_f$ | Turn-Off Fall Time | | | 14.2 | | ns |
| $Q_{rr}$ | Body Diode Reverse Recovery Charge | IF=6A, dI/dt=100A/ms, $V_{DS}$=400V | | 0 | | nC |
| $Q_{oss}$ | Output Charge | IF=6A, dI/dt=100A/ms, $V_{DS}$=400V | | 42 | | nC |

**Notes:**

1. 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.
2. 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.
3. The value of $R_{\theta JA}$ is measured with the device in a still air environment with $T_A$ =25°C.
4. $C_{o(er)}$ is a fixed capacitance that gives the same stored energy as $C_{oss}$ while $V_{DS}$ is rising from 0 to 80% $V_{(BR)DSS}$.
5. $C_{o(tr)}$ is a fixed capacitance that gives the same charging time as $C_{oss}$ while $V_{DS}$ is rising from 0 to 80% $V_{(BR)DSS}$
6. 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.
7. The static characteristics in Figures 1 to 7 are obtained using <300ms pulses, duty cycle 0.5% max.

## Typical Characteristics

$T_A$ = 25 °C, $V_{IN}$ = V, unless otherwise specified

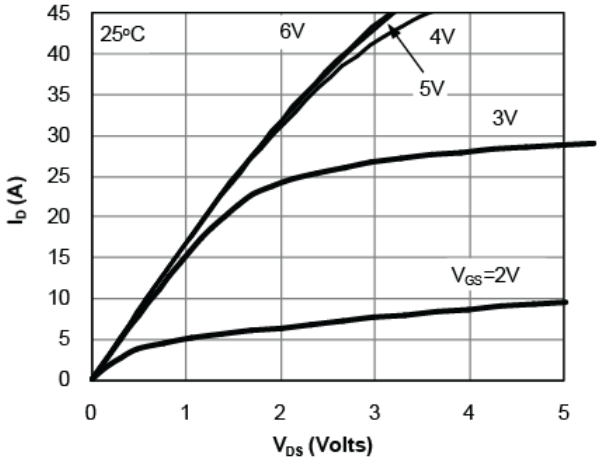



Figure 1. On-Region Characteristics

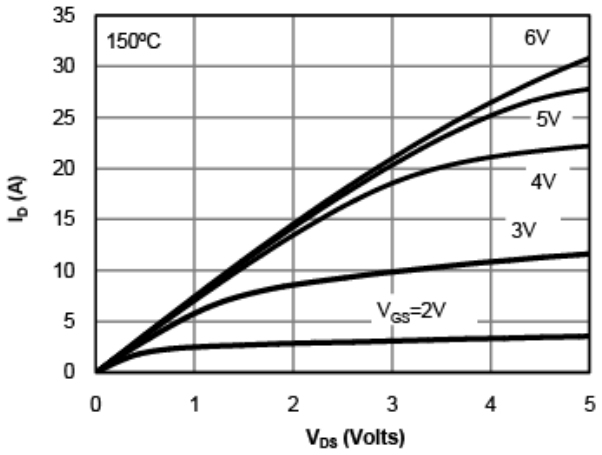



Figure 2. High Temperature On-Region

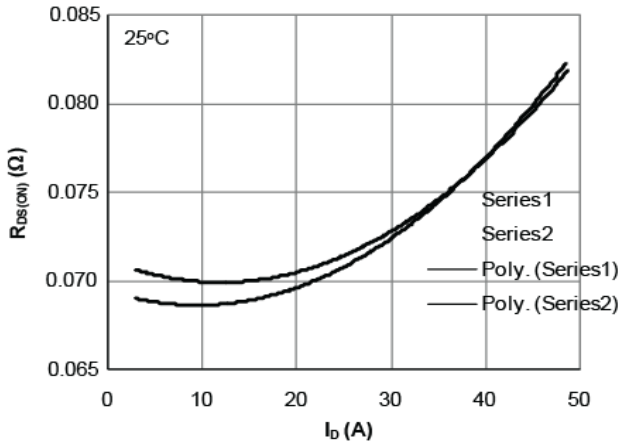



Figure 3. On-Resistance vs. Drain Current and Gate Voltage

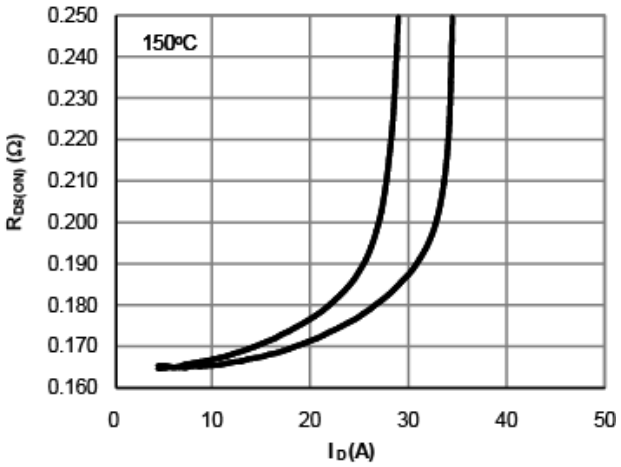



Figure 4. On-Resistance vs. Drain Current and Gate Voltage

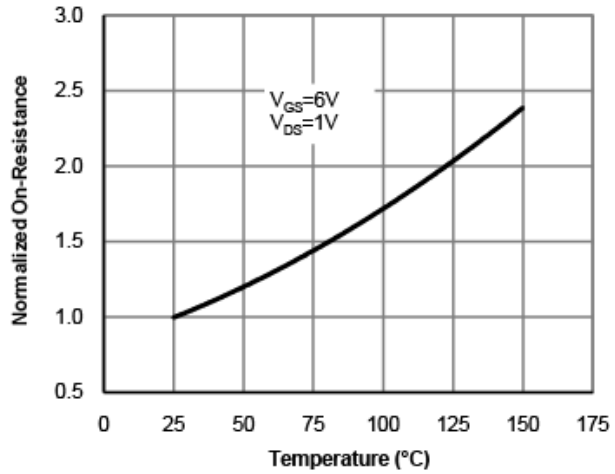



Figure 5. On-Resistance vs. Junction Temperature

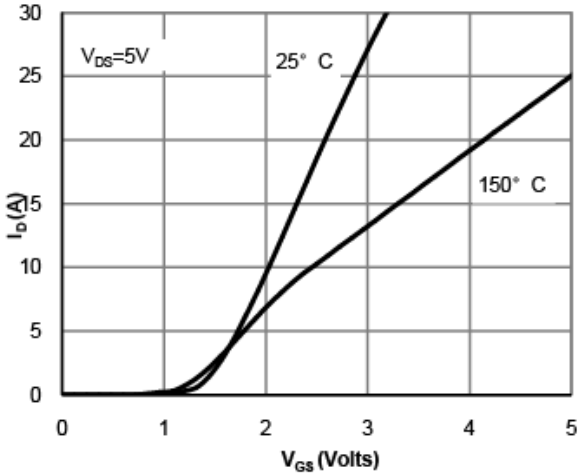



Figure 6. Transfer Characteristics

## Typical Characteristics

$T_A$ = 25 °C, $V_{IN}$ = V, unless otherwise specified

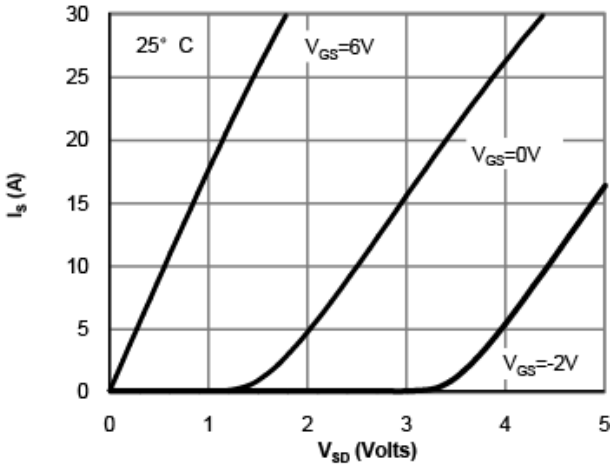



Figure 7. Body-Diode Characteristics

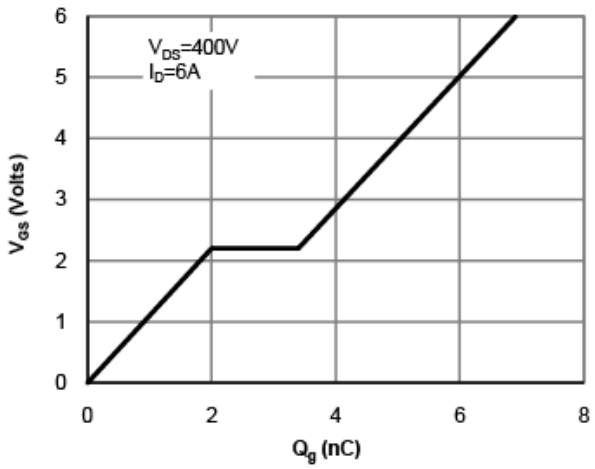



Figure 8. Gate-Charge Characteristics

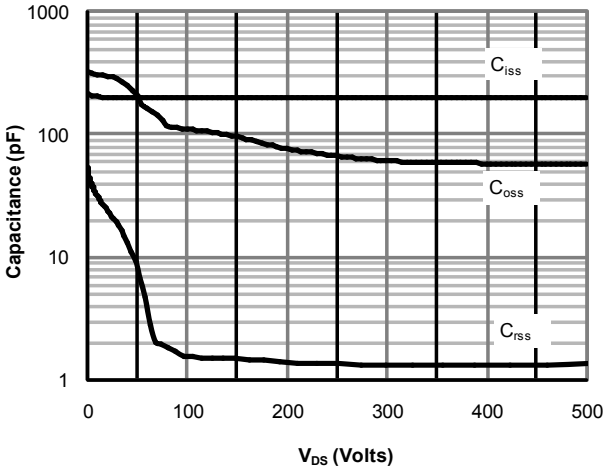



Figure 9. Capacitance Characteristics

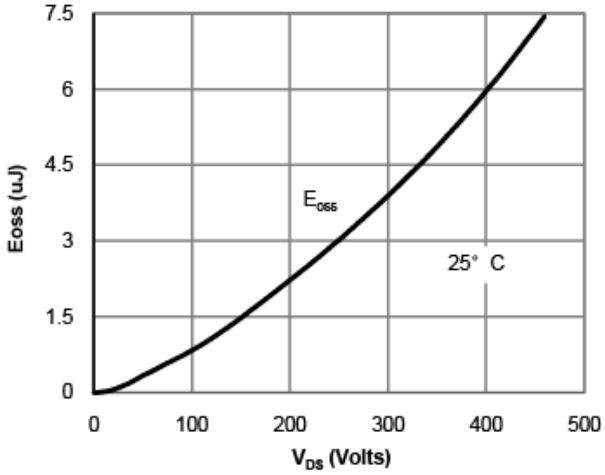



Figure 10. Coss Stored Energy

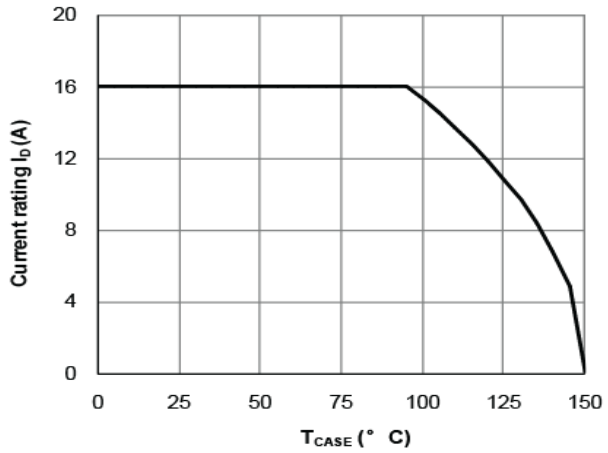



Figure 11. Current De-rating (Note 6)

## Typical Characteristics

$T_A$ = 25 °C, $V_{IN}$ = V, unless otherwise specified

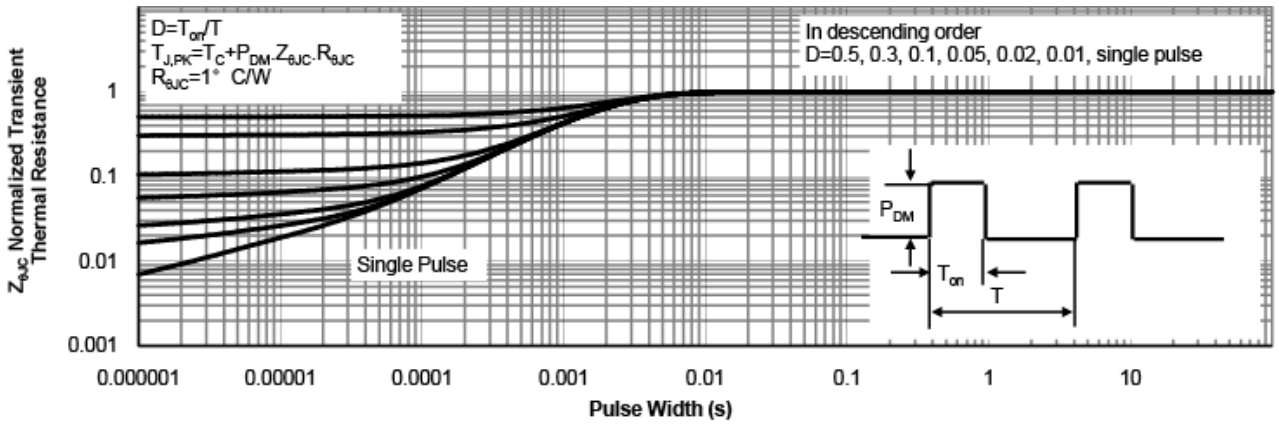
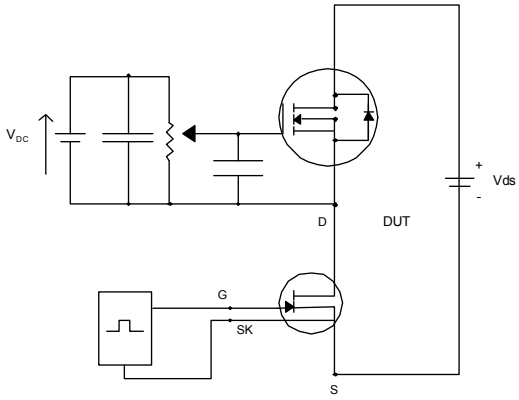
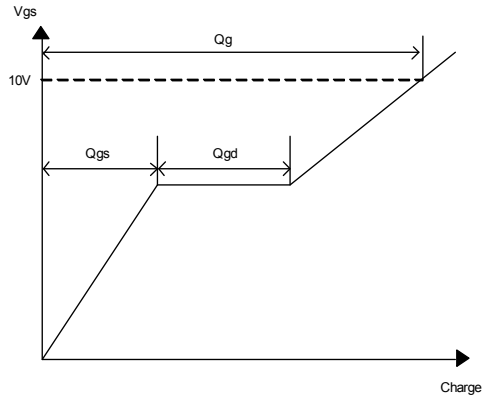



**Figure 12. Normalized Maximum Transient Thermal Impedance for TO-220F Pb Free (Note 6)**

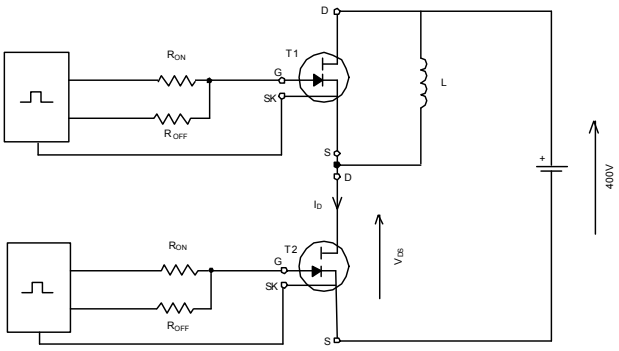
## Test Circuits and Waveforms

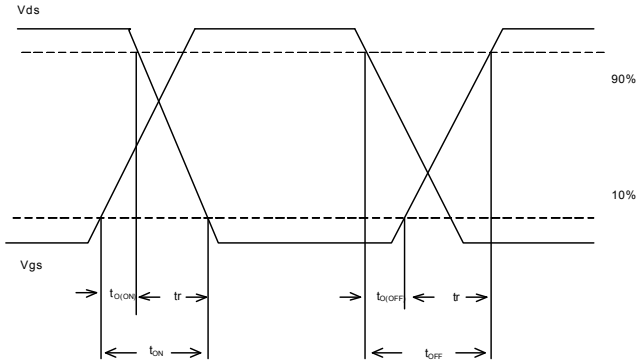
### Gate Charge Test Circuit & Waveforms



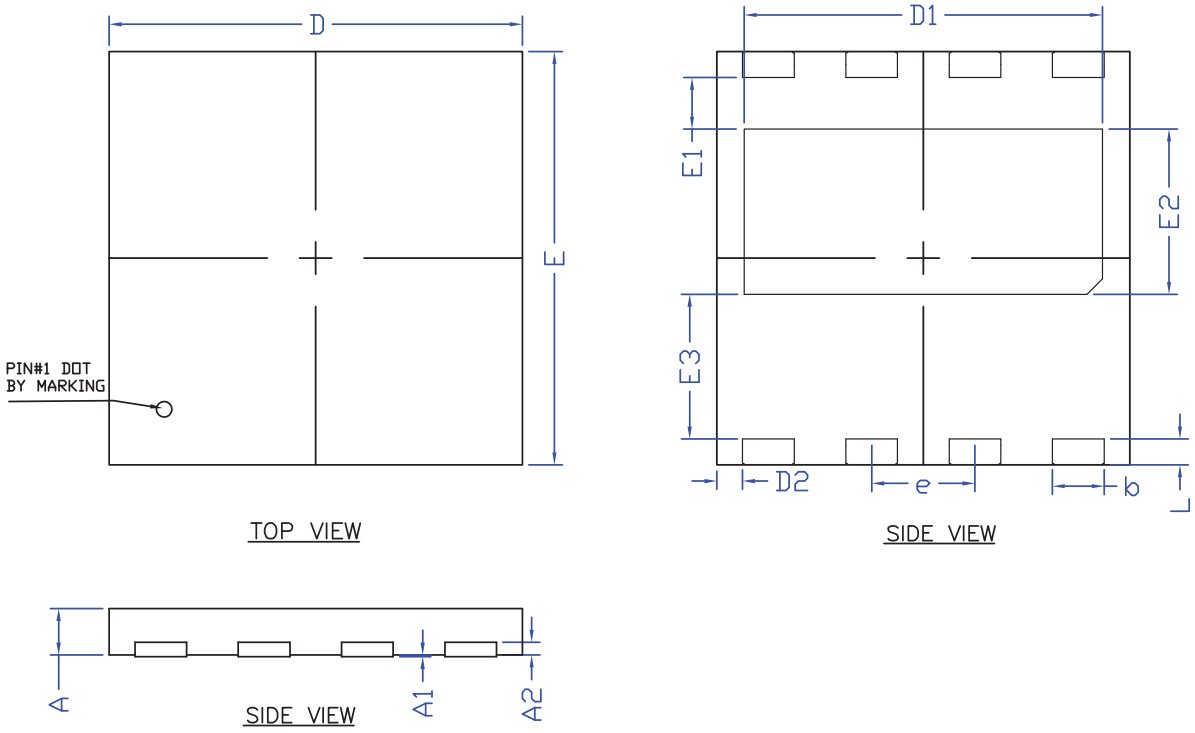




### Resistive Switching Test Circuit & Waveforms

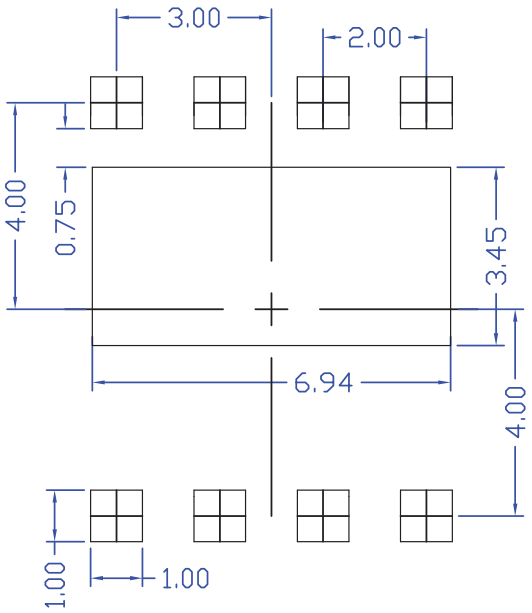


## Package Dimensions, DFN8x8-8L




RECOMMENDED LAND PATTERN



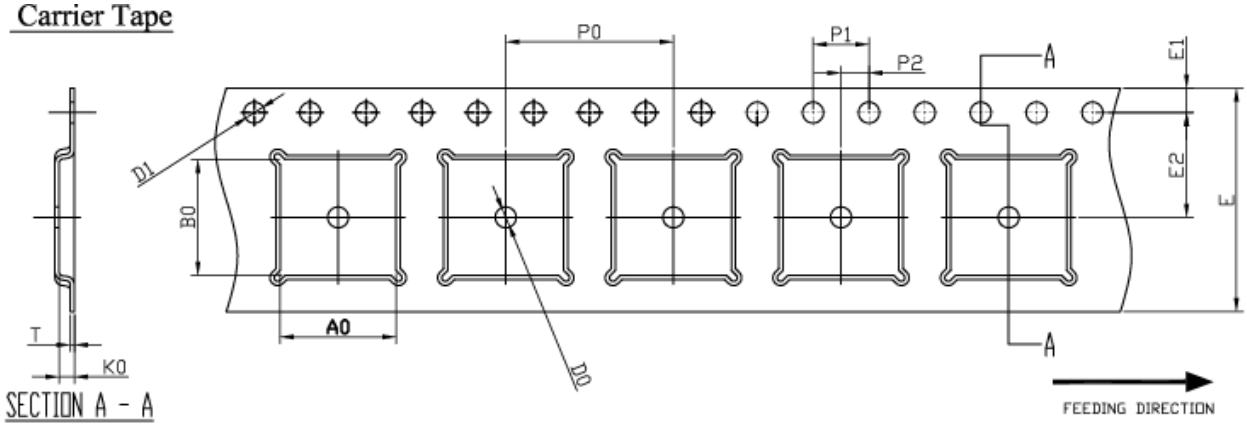

| SYMBOLS | DIMENSIONS IN MILLIMETERS | | | DIMENSIONS IN INCHES | | |
|---|---|---|---|---|---|---|
| | MIN | NOM | MAX | MIN | MON | MAX |
| A | 0.800 | | 1.100 | 0.031 | | 0.043 |
| A1 | 0.000 | | 0.050 | 0.000 | | 0.002 |
| A2 | 0.150 | 0.250 | 0.350 | 0.006 | 0.010 | 0.014 |
| b | 0.900 | 1.000 | 1.100 | 0.035 | 0.039 | 0.043 |
| D | 7.900 | 8.000 | 8.100 | 0.311 | 0.315 | 0.319 |
| D1 | 6.840 | 6.940 | 7.040 | 0.269 | 0.273 | 0.277 |
| D2 | 0.400 | 0.500 | 0.600 | 0.016 | 0.020 | 0.024 |
| E | 7.900 | 8.000 | 8.100 | 0.311 | 0.315 | 0.319 |
| E1 | 0.900 | 1.000 | 1.100 | 0.035 | 0.039 | 0.043 |
| E2 | 3.100 | 3.200 | 3.300 | 0.122 | 0.126 | 0.130 |
| E3 | 2.700 | 2.800 | 2.900 | 0.106 | 0.110 | 0.114 |
| e | 2.00 B.S.C. | | | 0.079 B.S.C. | | |
| L | 0.400 | 0.500 | 0.600 | 0.016 | 0.020 | 0.024 |

UNIT: mm

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

## Tape and Reel, DFN8x8-8L

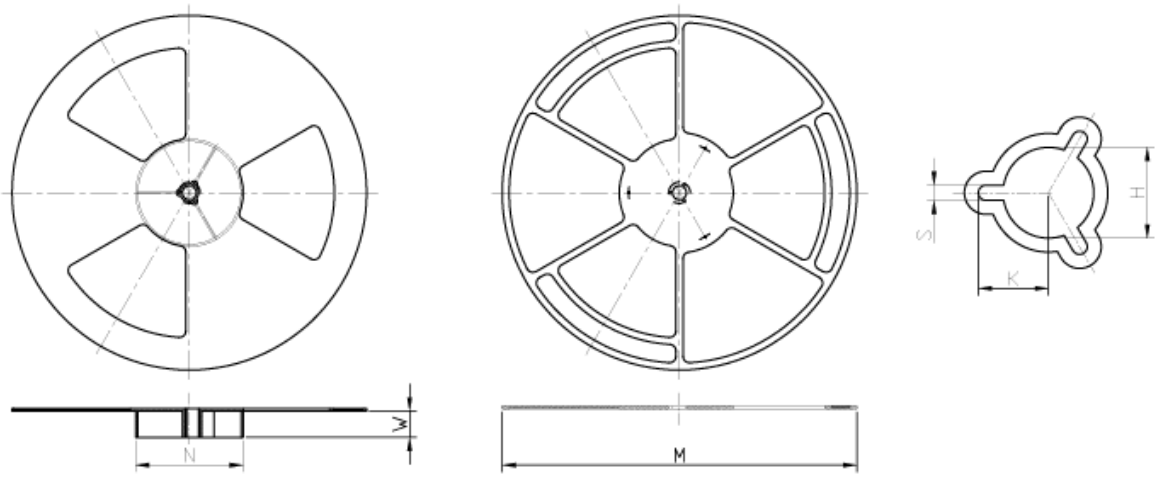
### Carrier Tape




UNIT: MM

| PACKAGE | A0 | B0 | K0 | D0 | D1 | E | E1 | E2 | P0 | P1 | P2 | T |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DFN8x8 (16 mm) | 8.30 ±0.10 | 8.30 ±0.10 | 1.10 ±0.10 | 1.50 MIN. | 1.50 +0.10 0.00 | 16.00 ±0.30 | 1.75 ±0.10 | 7.50 ±0.10 | 12.00 ±0.10 | 4.00 ±0.10 | 2.00 ±0.10 | 0.30 ±0.10 |

### Reel

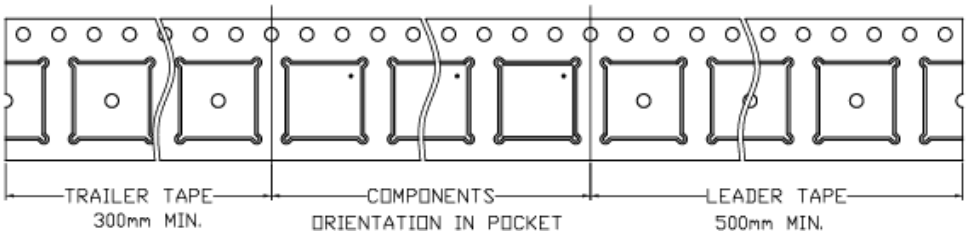



UNIT: MM

| TAPE SIZE | REEL SIZE | M | N | W | H | K | S |
|---|---|---|---|---|---|---|---|
| 16 mm | ø330 | ø330.00 MAX. | ø100.00 MIN. | 16.4 +2.0 −0.0 | ø13.0 +0.5 −0.2 | 10.1 MIN. | 1.5 MIN. |

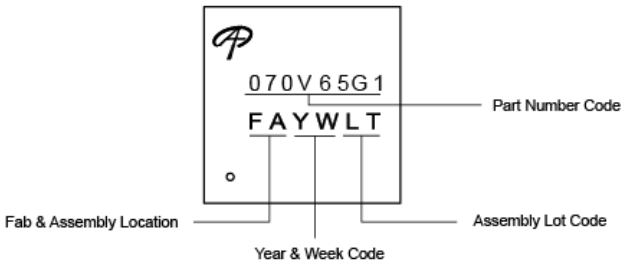
### Tape

Leader / Trailer & Orientation



## Part Marking

AONV070V65G1
(DFN8x8)




| PART NO. | DESCRIPTION | CODE |
|---|---|---|
| AONV070V65G1 | Green product | 070V65G1 |