ALPHA & OMEGA SEMICONDUCTOR

# AOK065V65X2

## 650V αSiC Silicon Carbide Power MOSFET

### Features

- Proprietary αSiC MOSFET technology
- Low loss, fast switching speeds with low $R_G$
- Optimized drive voltage ($V_{GS}$ =15V) for broad driver compatibility
- Robust body diode and low Qrr

### Product Summary

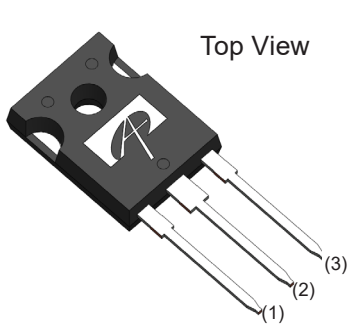
| | |
|---|---|
| $V_{DS}$ @ $T_{J, max}$ | 650V |
| $I_{DM}$ | 85A |
| $R_{DS(ON), typ}$ | 65mΩ |
| $Q_{rr}$ | 104nC |
| $E_{OSS}$ @ 400V | 11µJ |
| 100% UIS Tested | |

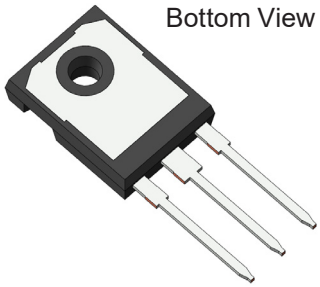
GREEN Product

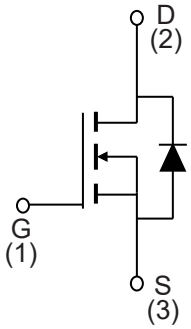
### Applications

- Renewable
- EV Charger
- Solar Inverters
- Industrial
- UPS
- SMPS
- Motor Drives

### Pin Configuration




| Ordering Part Number | Package Type | Form | Shipping Quantity |
|---|---|---|---|
| AOK065V65X2 | TO-247-3L | Tube | 30/Tube |

### Absolute Maximum Ratings

$T_A$ = 25°C, unless otherwise noted

| Symbol | Parameter | | AOK065V120X2 | Units |
|---|---|---|---|---|
| $V_{DS}$ | Drain-Source Voltage | | 650 | V |
| $V_{GS, MAX}$ | Gate-Source Voltage | Maximum | -8/+18 | V |
| $V_{GS,OP,TRANS}$ | | Max Transient[A] | -8/+20 | |
| $V_{GS,OP}$ | | Recommended Operating[B] | -5/+15 | |
| $I_D$ | Continuous Drain Current | $T_C$ = 25°C | 40.3 | A |
| | | $T_C$ = 100°C | 29.6 | |
| $I_{DM}$ | Pulsed Drain Current[C] | | 85 | |
| $E_{AS}$ | Single Pulsed Avalanche Energy[D] | | 250 | mJ |
| $P_D$ | Power Dissipation[C] | | 187.5 | W |
| $T_J$, $T_{STG}$ | Junction and Storage Temperature Range | | -55 to 175 | °C |
| $T_L$ | Maximum lead temperature for soldering purpose, 1/8" from case for 5 seconds | | 300 | °C |

## Thermal Characteristics

| Symbol | Parameter | AOK065V120X2 | Units |
|---|---|---|---|
| $R_{\theta JA}$ | Maximum Junction-to-Ambient(E,F) | 40 | °C/W |
| $R_{\theta JC}$ | Maximum Junction-to-Case(G) | 0.8 | °C/W |

## Electrical Characteristics

$T_A$ = 25°C, unless otherwise noted

| Symbol | Parameter | Conditions | | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|---|
| **STATIC** | | | | | | | |
| $V_{(BR)DSS}$ | Drain-Source Breakdown Voltage | $I_D$=250µA, $V_{GS}$=0V, $T_J$=25°C | | 650 | | | V |
| | | $I_D$=250µA, $V_{GS}$=0V, $T_J$=150°C | | | 650 | | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$=650V, $V_{GS}$=0V | | | | 50 | µA |
| $I_{GSS}$ | Gate-Source Leakage Current | $V_{DS}$=0V, $V_{GS}$=+15/-5V | | | | ±100 | nA |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$=$V_{GS}$, $I_D$=10mA | | 1.8 | 2.8 | 3.5 | V |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$=15V, $I_D$=10A | $T_J$ = 25°C | | 65 | 85 | mΩ |
| | | | $T_J$= 150°C | | 90 | | mΩ |
| $g_{fs}$ | Forward Transconductance | $V_{DS}$=20V, $I_D$=20V | | | 12 | | S |
| $V_{SD}$ | Diode Forward Voltage | $I_S$=10A,$V_{GS}$=-5V | | | 4.1 | 5 | V |
| **DYNAMIC** | | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{GS}$=0V, $V_{DS}$=400V, f=1MHz | | | 1733 | | pF |
| $C_{oss}$ | Output Capacitance | | | | 98 | | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | | 5.8 | | pF |
| $E_{oss}$ | Coss Stored Energy | | | | 11 | | µJ |
| $R_G$ | Gate Resistance | f=1MHz | | 0.9 | 1.7 | 2.5 | Ω |
| **SWITCHING** | | | | | | | |
| $Q_g$ | Total Gate Charge | $V_{GS}$=-5/+15V, $V_{DS}$=400V, $I_D$=20A | | | 58.8 | | nC |
| $Q_{gs}$ | Gate Source Charge | | | | 24.6 | | nC |
| $Q_{gd}$ | Gate Drain Charge | | | | 19.7 | | nC |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{GS}$=0V/+15V, $V_{DS}$=400V, $I_D$=20A, $R_G$=2.5Ω, La = 120µH, FWD: AOK065V65X2 | | | 10.4 | | ns |
| $t_r$ | Turn-On Rise Time | | | | 25.5 | | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | | | 12.4 | | ns |
| $t_f$ | Turn-Off Fall Time | | | | 3.9 | | ns |
| $E_{on}$ | Turn-On Energy | | | | 131.5 | | µJ |
| $E_{off}$ | Turn-Off Energy | | | | 8.9 | | µJ |
| $E_{tot}$ | Total Switching Energy | | | | 140.4 | | µJ |
| $t_{rr}$ | Body Diode Reverse Recovery Time | $I_F$=13.2A,dI/dt=1200A/µs, $V_{DS}$=400V=33ns | | | 33 | | ns |
| $I_{rm}$ | Peak Reverse Recovery Current | $I_F$=13.2A,dI/dt=750A/µs, $V_{DS}$=400V=6.4A | | | 6.4 | | A |
| $Q_{rr}$ | Body Diode Reverse Recovery Charge | $I_F$=13.2A,dI/dt=750A/µs, $V_{DS}$=400V=104nC | | | 104 | | nC |

**Notes:**
A. < 1% duty cycle, f >1Hz
B. Device can be operated at $V_{GS}$=0/15V. Actual operating $V_{GS}$ will depend on application specifics such as parasitic inductance and dV/dt but should not exceed maximum ratings.
C. The power dissipation $P_D$ is based on $T_{J(MAX)}$=175°C, using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.
D. L=5mH, $I_{AS}$=4.3A, $R_G$=25Ω, Starting $T_J$=25°C.
E. The value of $R_{\theta JA}$ is measured with the device in a still air environment with $T_A$ =25°C.
F. The $R_{\theta JA}$ is the sum of the thermal impedance from junction to case $R_{\theta JC}$ and case to ambient.
G. The value of $R_{\theta JC}$ is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of $T_{J(MAX)}$=175°C.
H. The static characteristics in Figures 1 to 8 are obtained using <300ms pulses, duty cycle 0.5% max.
I. These curves are based on $R_{\theta JC}$ which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of $T_{J(MAX)}$ =175°C. The SOA curve provides a single pulse rating.

## Typical Electrical and Thermal Characteristics

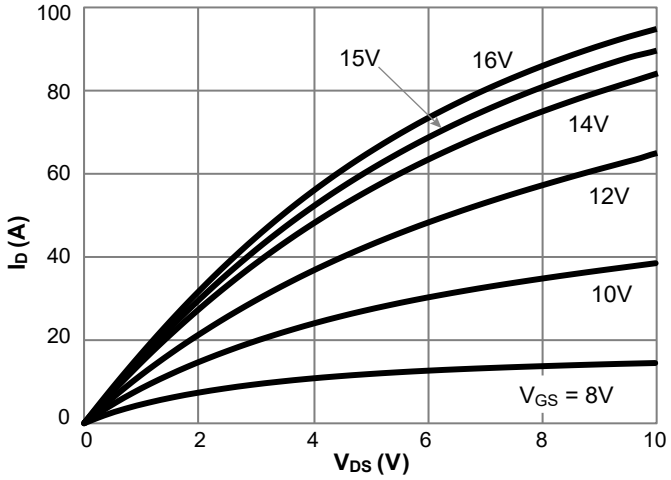



Figure 1. On-Region Characteristics $T_J$ = 25°C

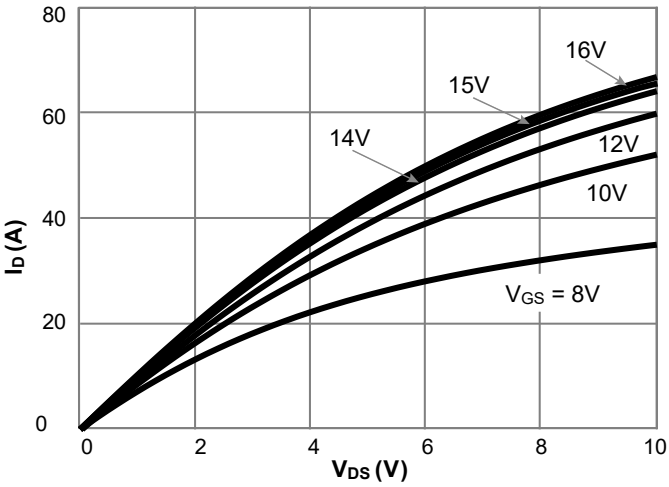



Figure 2. On-Region Characteristics $T_J$ = 175°C

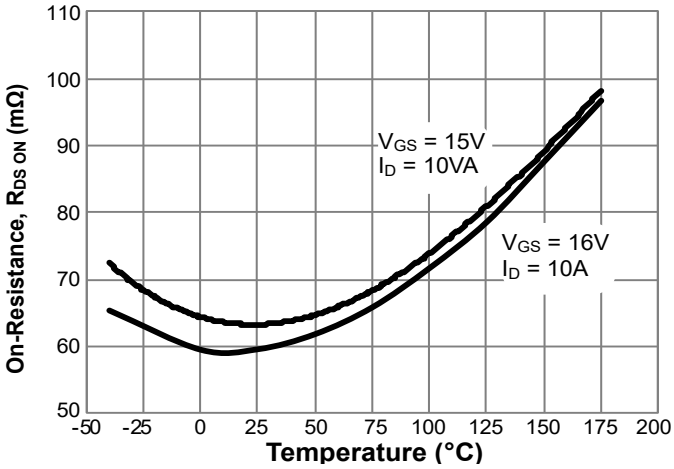



Figure 3. On-Resistance vs. Junction Temperature

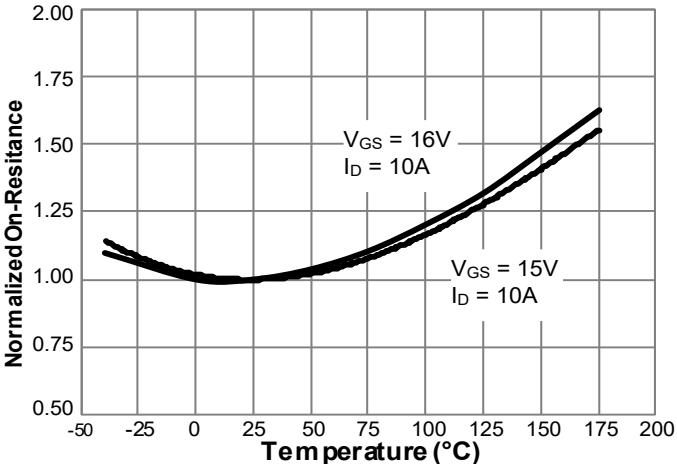



Figure 4. Normalized On-Resistance vs. Junction Temperature

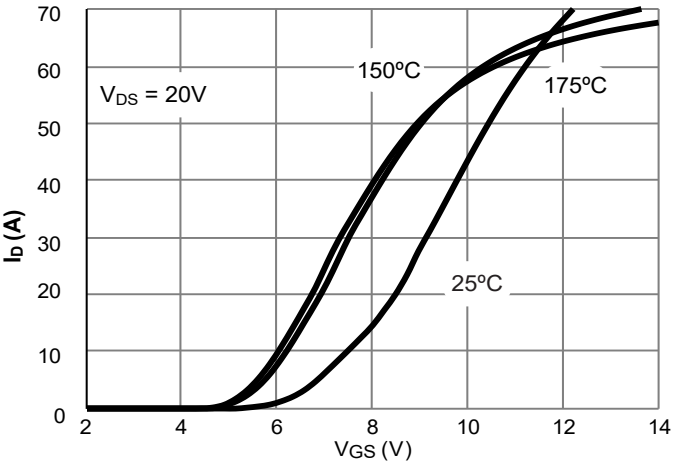



Figure 5. Transfer Characteristics

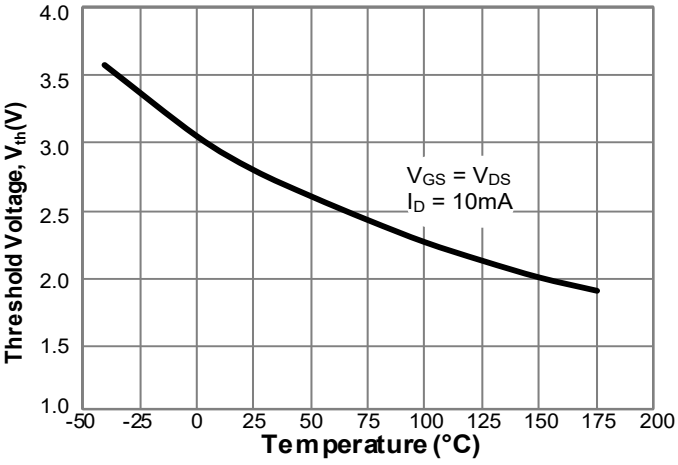



Figure 6. Threshold Voltage vs. Junction Temperature

## Typical Electrical and Thermal Characteristics

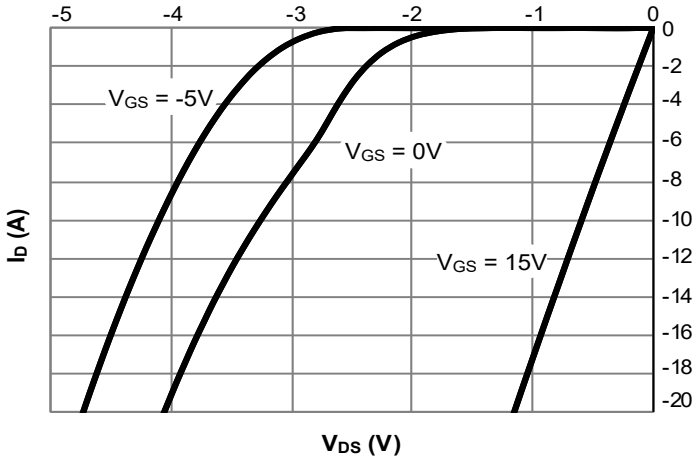



Figure 7. Body-Diode Characteristics at 25°C

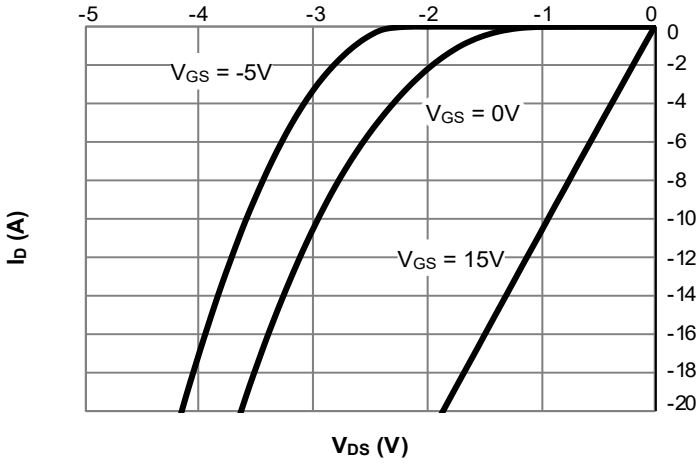



Figure 8. Body-Diode Characteristics at 175°C

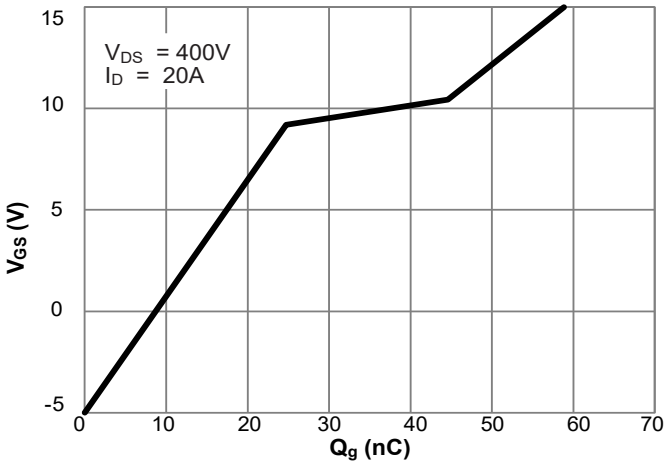



Figure 9. Gate-Charge Characteristics

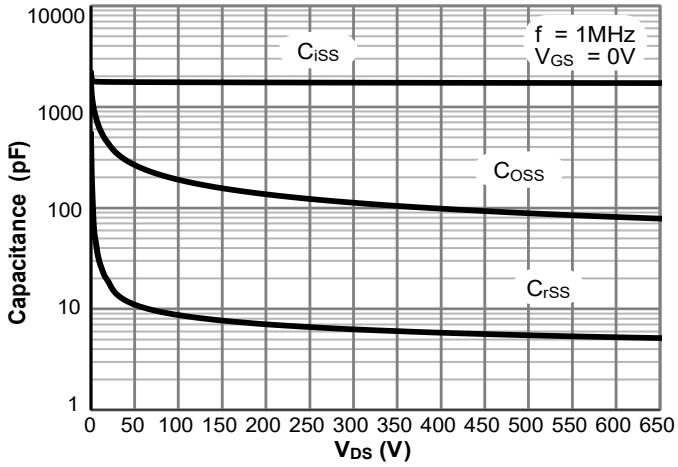



Figure 10. Capacitance Characteristics

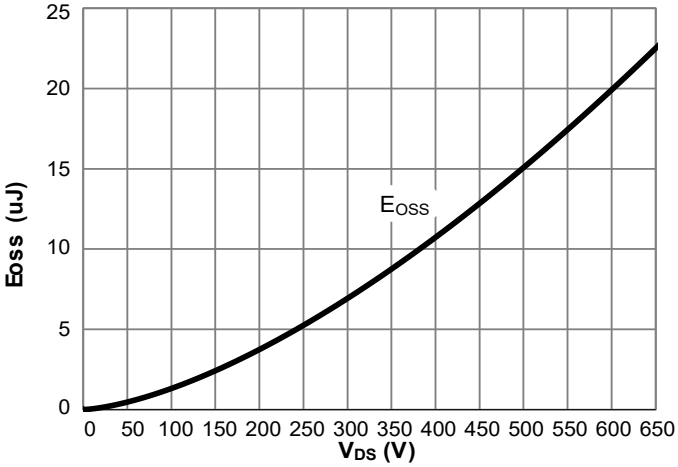



Figure 11. Coss Stored Energy

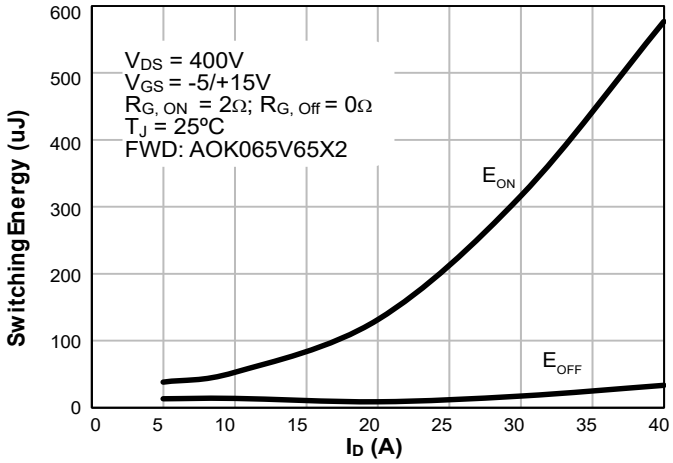



Figure 12. Switching Energy vs. Drain Current

## Typical Electrical and Thermal Characteristics

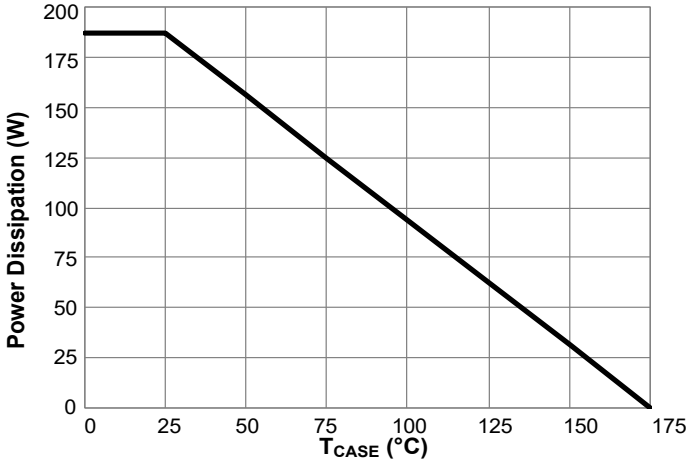



Figure 13. Switching Energy vs. Drain Current

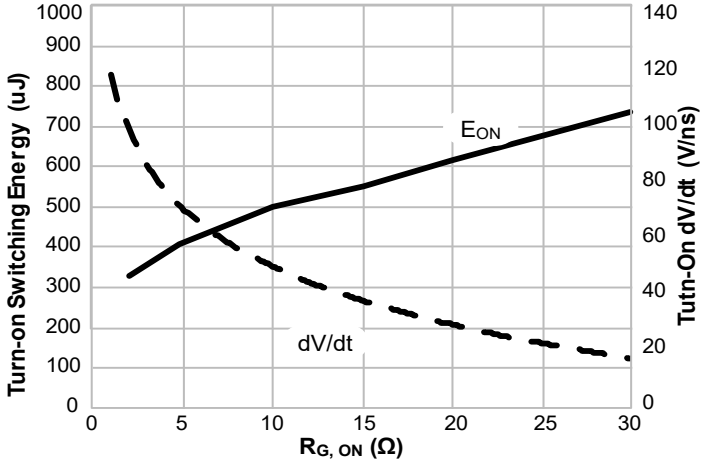



Figure 14. Power De-rating (Note I)

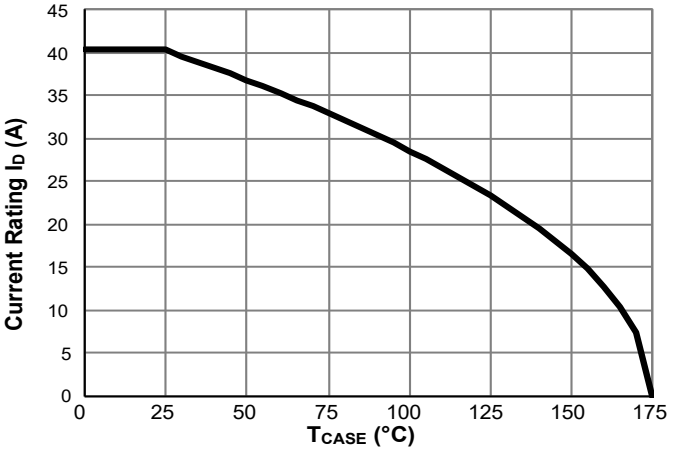



Figure 15. Current De-rating (Note I)

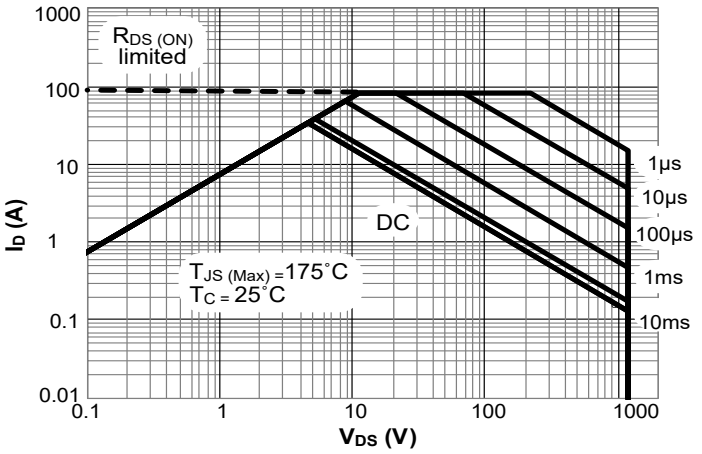



Figure 16. Maximum Forward Biased Safe Operating Area for AOK065V65X2 (Note I)

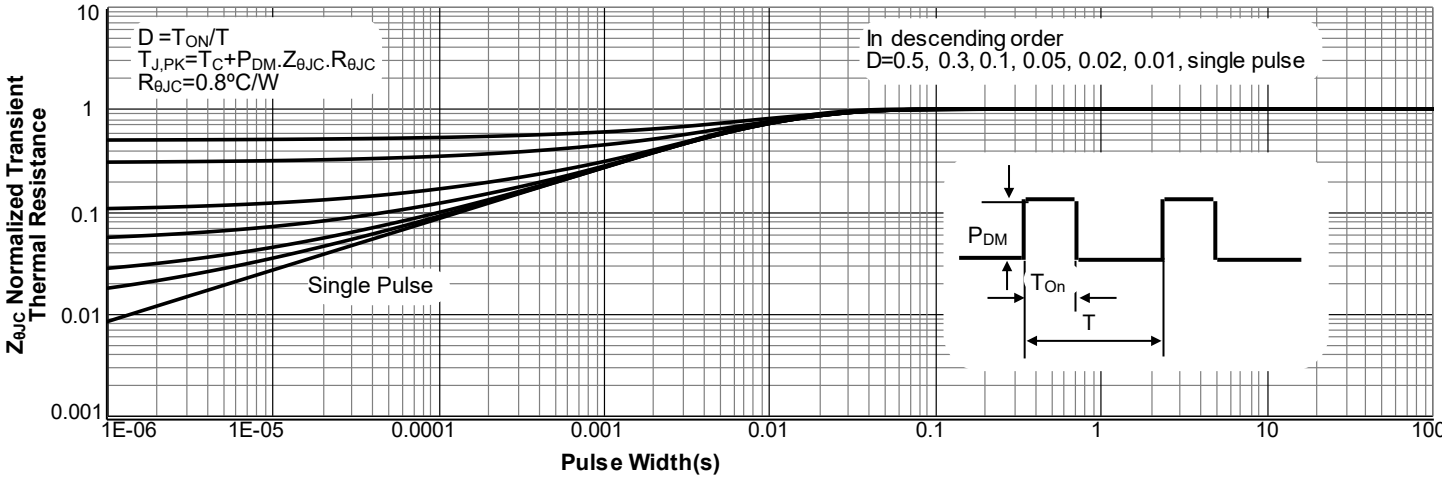



Figure 17. Normalized Maximum Transient Thermal Impedance for AOK065V65X2 (Note I)

## Test Circuits and Waveforms

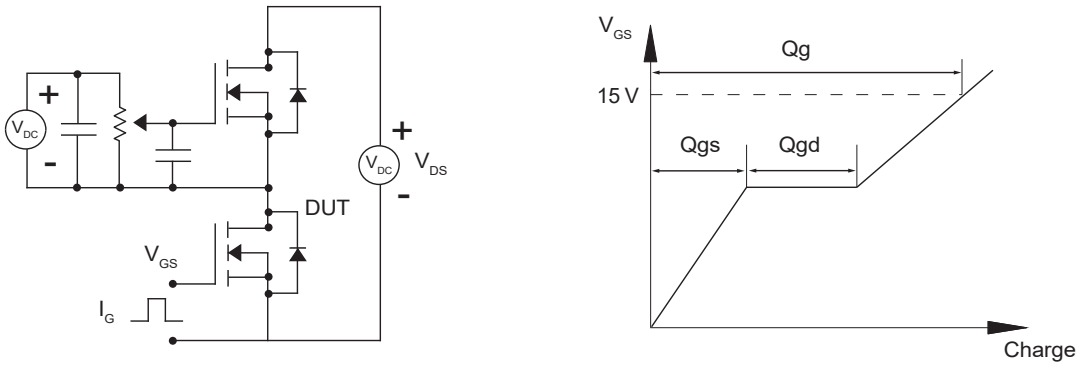



**Figure 18. Gate Charge Test Circuits and Waveforms**

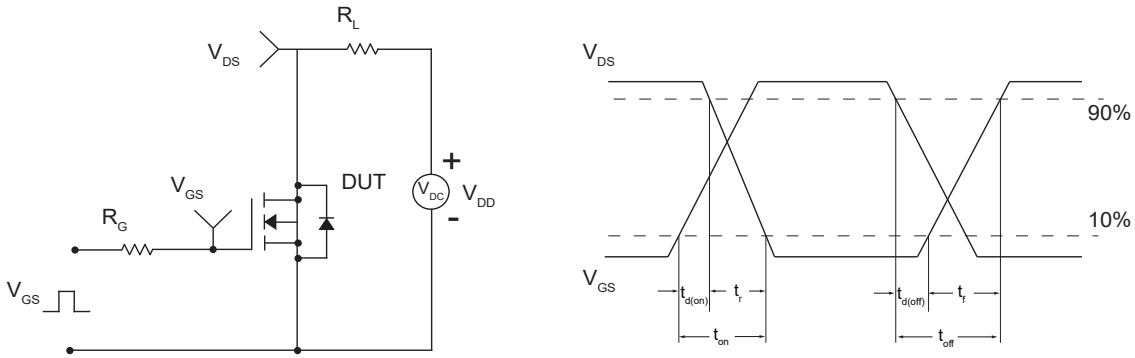



**Figure 19. Resistive Switching Test Circuit and Waveforms**

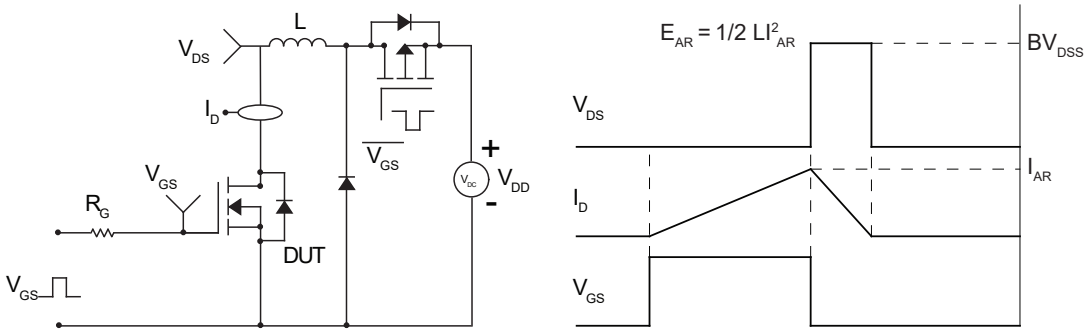



**Figure 20. Unclamped Inductive Switching (UIS) Test Circuit and Waveforms**

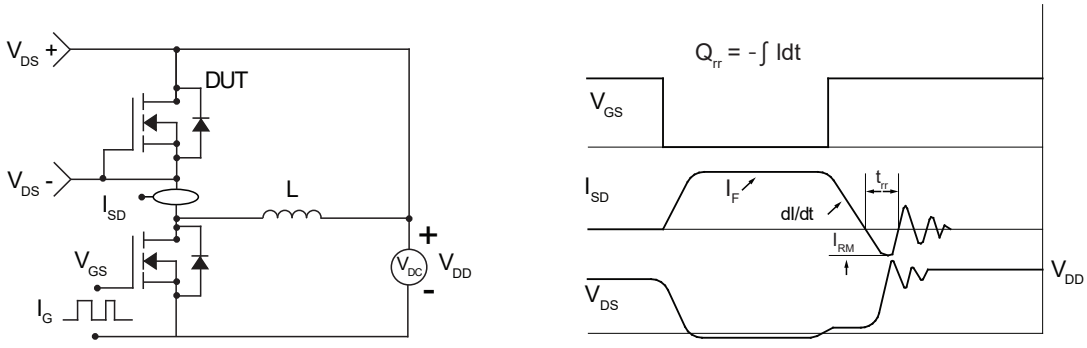
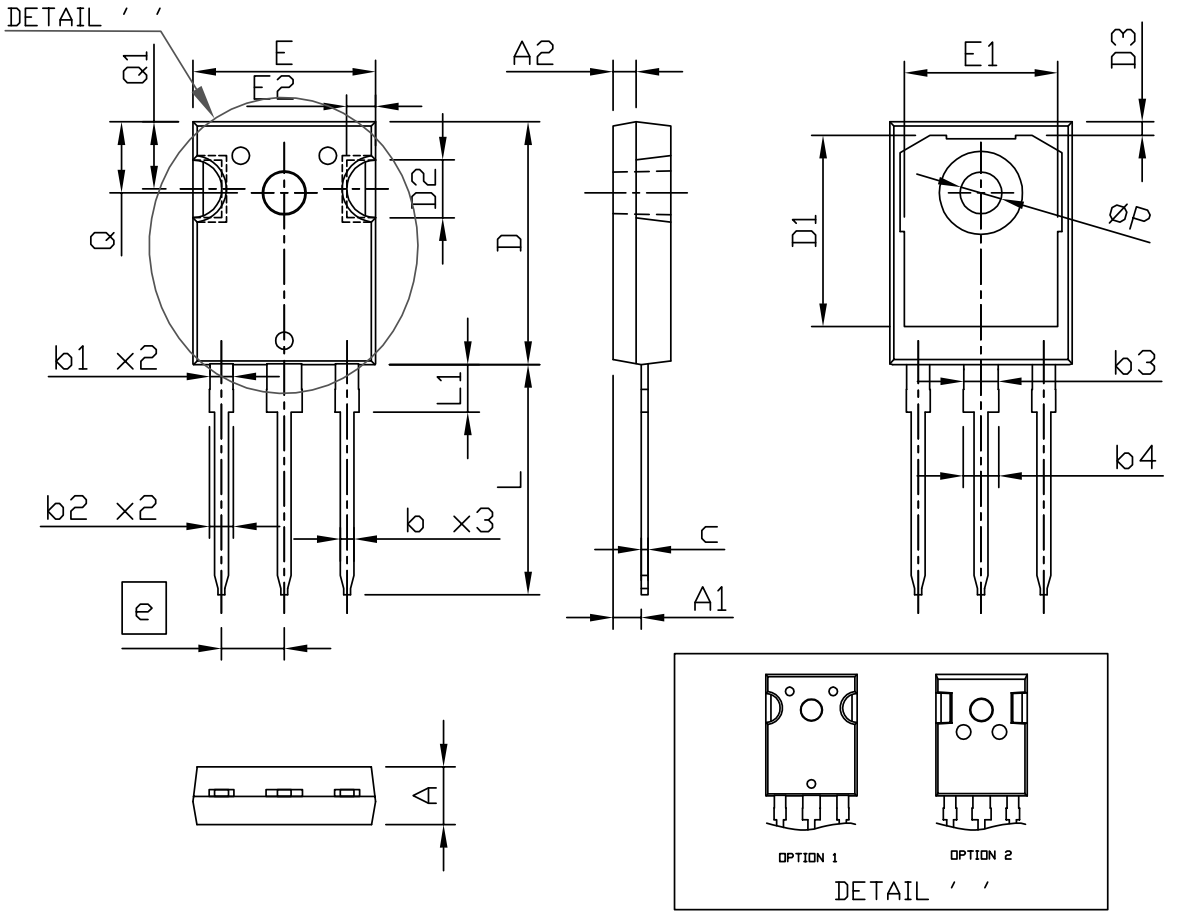


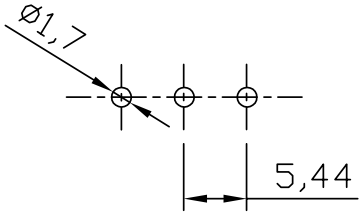

**Figure 21. Diode Recovery Test Circuits and Waveforms**

## Package Dimensions, TO247-3L




| SYMBOLS | DIMENSIONS IN MILLIMETERS | | | DIMENSIONS IN INCHES | | |
|---|---|---|---|---|---|---|
| | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 4.90 | 5.00 | 5.10 | 0.193 | 0.197 | 0.201 |
| A1 | 2.31 | 2.42 | 2.52 | 0.091 | 0.095 | 0.099 |
| A2 | 1.90 | 2.00 | 2.10 | 0.075 | 0.079 | 0.083 |
| b | 1.16 | 1.22 | 1.27 | 0.046 | 0.048 | 0.050 |
| b1 | 1.96 | 2.02 | 2.07 | 0.078 | 0.080 | 0.081 |
| b2 | 2.00 | 2.10 | 2.20 | 0.079 | 0.083 | 0.087 |
| b3 | 2.96 | 3.02 | 3.07 | 0.117 | 0.119 | 0.121 |
| b4 | 3.00 | 3.10 | 3.20 | 0.118 | 0.122 | 0.126 |
| c | 0.59 | 0.62 | 0.66 | 0.023 | 0.024 | 0.026 |
| D | 20.90 | 21.00 | 21.10 | 0.823 | 0.827 | 0.831 |
| D1 | 16.25 | 16.55 | 16.85 | 0.640 | 0.652 | 0.663 |
| D2 | | 5.00 TYP | | | 0.197 TYP | |
| D3 | 1.05 | 1.20 | 1.35 | 0.041 | 0.047 | 0.053 |
| e | | 5.44 BSC | | | 0.214 BSC | |
| E | 15.70 | 15.80 | 15.90 | 0.618 | 0.622 | 0.626 |
| E1 | 13.06 | 13.26 | 13.50 | 0.514 | 0.522 | 0.530 |
| E2 | | 2.50 TYP | | | 0.098 TYP | |
| L | 19.72 | 19.92 | 20.12 | 0.776 | 0.784 | 0.792 |
| L1 | --- | --- | 4.30 | --- | --- | 0.169 |
| Q | | 6.15 BSC | | | 0.242 BSC | |
| Q1 | 5.60 | 5.80 | 6.00 | 0.220 | 0.228 | 0.236 |
| ØP | 3.55 | 3.60 | 3.70 | 0.140 | 0.142 | 0.146 |

RECOMMENDED LAND PATTERN

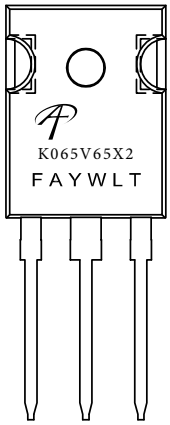



UNIT: mm

NOTE
1. PAKCAGE 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.

## Part Marking

TO-247-3L




## LEGAL DISCLAIMER

Applications or uses as critical components in life support devices or systems are not authorized. Alpha and Omega Semiconductor does not assume any liability arising out of such applications or uses of its products. AOS reserves the right to make changes to product specifications without notice. It is the responsibility of the customer to evaluate suitability of the product for their intended application. Customer shall comply with applicable legal requirements, including all applicable export control rules, regulations and limitations.

AOS's products are provided subject to AOS's terms and conditions of sale which are set forth at:
http://www.aosmd.com/terms_and_conditions_of_sale

## LIFE SUPPORT POLICY

ALPHA AND OMEGA SEMICONDUCTOR PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS.

As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury of the user.

2. A critical component in any component of a life support, device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

ENTEGRECİ

Bu belge www.entegreci.com üzerinden sunulmaktadır.

# Elektronik komponent tedarikinde Entegreci

Entegreci, Eskişehir merkezli, Türkiye geneline satış yapan bir elektronik komponent mağazasıdır. Entegreler (IC), mikrodenetleyiciler, transistörler, diyotlar, pasif elemanlar, konnektörler, modüller ve geliştirme kartları tek adetten seri üretim adetlerine kadar satılır. Ürün sayfalarında güncel stok durumunu, fiyatı ve datasheet bağlantısını bulabilirsiniz.

### Parça koduyla arama

Üretici parça numarasını yazın; stok ve fiyatı hemen görün.

**www.entegreci.com**

### Ürün kategorileri

Entegreden kapasitöre tüm elektronik komponent kategorileri.

**Kategorilere göz atın**

### Üreticiler

Aradığınız üreticinin ürünlerini tek sayfada inceleyin.

**Üreticileri görün**

### Toplu alım ve teklif

Listede olmayan ya da yüksek adetli parçalar için teklif isteyin.

**Teklif isteyin**

**www.entegreci.com** | **destek@entegreci.com** | **0850 305 90 34**

Entegreci is an online electronic components store based in Türkiye. Search by manufacturer part number to see stock, prices and datasheets for integrated circuits, microcontrollers, transistors, passive components and connectors, or request a quote for parts that are not listed.

Bu sayfa Entegreci tarafından eklenmiştir. Belgenin önceki sayfaları asıl yayıncısına aittir ve içeriği değiştirilmemiştir; en güncel sürüm için belgenin yayıncısına başvurun.