

**SuperMOS –SOT-23 20V  $BV_{DSS}$ ,  $13m\Omega R_{DS(ON)}$ , 7.5A  $I_D$  N-channel MOSFET**

**1. Description**

The AO3416 is N-Channel enhancement MOS Field Effect Transistor. Uses advanced trench technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. Device is suitable for use in DC-DC conversion, power switch and charging circuit. Standard Product AO3416 is Pb-free.

**2. Features**

- 20V,  $R_{DS(ON)}=13m\Omega(Typ.)$ ,  $V_{GS}=4.5V$   
 $R_{DS(ON)}=16m\Omega(Typ.)$ ,  $V_{GS}=2.5V$
- Use trench MOSFET technology
- High density cell design for low  $R_{DS(on)}$
- Material: Halogen free
- Reliable and rugged
- Avalanche Rated
- Low leakage current

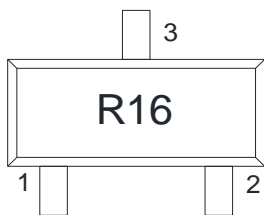
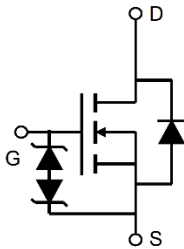
**3. Applications**

- PWM applications
- Load switch
- Power management in portable/desktop PCs
- DC/DC conversion

**4. Ordering Information**

| Part Number | Package | Marking | Material     | Packing     | Quantity per reel | Flammability Rating | Reel Size |
|-------------|---------|---------|--------------|-------------|-------------------|---------------------|-----------|
| AO3416      | SOT-23  | R16     | Halogen free | Tape & Reel | 3,000 PCS         | UL 94V-0            | 7 inches  |

**5. Pin Configuration and Functions**

| Pin | Function | Outline   | Circuit Diagram   |
|-----|----------|---|---|
| 1   | Gate     |  |  |
| 2   | Source   |   |   |
| 3   | Drain    |   |   |

## 6. Specification

### Absolute Maximum Rating & Thermal Characteristics

Ratings at 25 °C ambient temperature unless otherwise specified.

| Parameter                      | Symbol     | Limit                  | Unit             |
|--------------------------------|------------|------------------------|------------------|
| Drain-Source Voltage           | $BV_{DSS}$ | 20                     | V                |
| Gate-Source Voltage            | $V_{GS}$   | $\pm 10$               | V                |
| Continuous Drain Current       | $I_D$      | $T_A=25^\circ\text{C}$ | 7.5              |
|                                |            | $T_A=75^\circ\text{C}$ | 5.8              |
| Maximum Power Dissipation      | $P_D$      | $T_A=25^\circ\text{C}$ | 1.39             |
|                                |            | $T_A=75^\circ\text{C}$ | 0.83             |
| Pulsed Drain Current           | $I_{DM}$   | 30                     | A                |
| Operating Junction Temperature | $T_J$      | 150                    | $^\circ\text{C}$ |
| Lead Temperature               | $T_L$      | 260                    | $^\circ\text{C}$ |
| Storage Temperature Range      | $T_{stg}$  | -55 to 150             | $^\circ\text{C}$ |

### Thermal resistance ratings

| Single Operation                       |                 |         |         |                    |
|--|-----------------|---------|---------|--------------------|
| Parameter                              | Symbol          | Typical | Maximum | Unit               |
| Junction-to-Ambient Thermal Resistance | $R_{\theta JA}$ | 70      | 90      | $^\circ\text{C/W}$ |

## Electrical Characteristics

At TA = 25°C unless otherwise specified

| Parameter  | Symbol       | Test Conditions   | Min. | Typ. | Max.     | Unit      |
|--|--------------|---|------|------|----------|-----------|
| <b>OFF CHARACTERISTICS</b>                       |              |   |      |      |          |           |
| Drain-to-Source Breakdown Voltage                | $BV_{DSS}$   | $V_{GS}=0V, I_D=250\mu A$                                 | 20   |      |          | V         |
| Zero Gate Voltage Drain Current                  | $I_{DSS}$    | $V_{DS}=20V, V_{GS}=0V$                                   |      |      | 1        | $\mu A$   |
| Gate-to-source Leakage Current                   | $I_{GSS}$    | $V_{DS}=0V, V_{GS}=\pm 10V$                               |      |      | $\pm 10$ | $\mu A$   |
| <b>ON CHARACTERISTICS</b>                        |              |   |      |      |          |           |
| Gate Threshold Voltage                           | $V_{GS(TH)}$ | $V_{GS}=V_{DS}, I_D=250\mu A$                             | 0.5  | 0.7  | 0.9      | V         |
| Drain-to-source On-resistance                    | $R_{DS(on)}$ | $V_{GS}=4.5V, I_D=7.5A$                                   |      | 13   | 17       | $m\Omega$ |
|  |              | $V_{GS}=2.5V, I_D=5A$                                     |      | 16   | 23       | $m\Omega$ |
| Forward transconductance                         | $g_{fs}$     | $V_{DS}=5V, I_D=7.5A$                                     |      |      | 40       | S         |
| <b>CHARGES, CAPACITANCES AND GATE RESISTANCE</b> |              |   |      |      |          |           |
| Input Capacitance                                | $C_{ISS}$    | $V_{GS}=0V, f=1MHz,$<br>$V_{DS}=10V$                      |      | 1300 |          | pF        |
| Output Capacitance                               | $C_{OSS}$    |   |      | 160  |          |           |
| Reverse Transfer Capacitance                     | $C_{RSS}$    |   |      | 88   |          |           |
| Total Gate Charge                                | $Q_{G(TOT)}$ | $V_{GS}=4.5V, V_{DS}=10V,$<br>$I_D=7.5A$                  |      | 10   |          | nC        |
| Gate-to-Source Charge                            | $Q_{GS}$     |   |      | 4.5  |          |           |
| Gate-to-Drain Charge                             | $Q_{GD}$     |   |      | 2.5  |          |           |
| <b>SWITCHING CHARACTERISTICS</b>                 |              |   |      |      |          |           |
| Turn-On Delay Time                               | $t_{d(ON)}$  | $V_{GS}=4.5V, V_{DS}=10V,$<br>$RL=1.5\Omega, R_G=3\Omega$ |      | 280  |          | ns        |
| Rise Time  | $t_r$        |   |      | 330  |          |           |
| Turn-Off Delay Time                              | $t_{d(OFF)}$ |   |      | 4    |          |           |
| Fall Time  | $t_f$        |   |      | 2.5  |          |           |
| <b>BODY DIODE CHARACTERISTICS</b>                |              |   |      |      |          |           |
| Forward Voltage                                  | $V_{SD}$     | $V_{GS}=0V, I_S=7.5A$                                     |      |      | 1.5      | V         |

7. Typical Characteristic

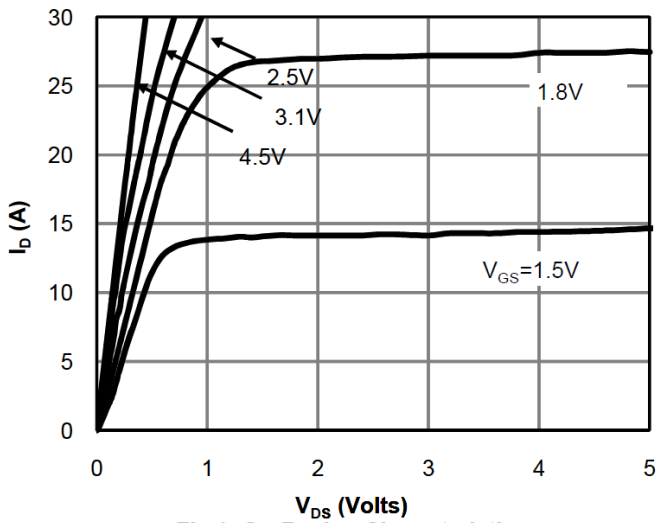


Fig 1: On-Region Characteristics

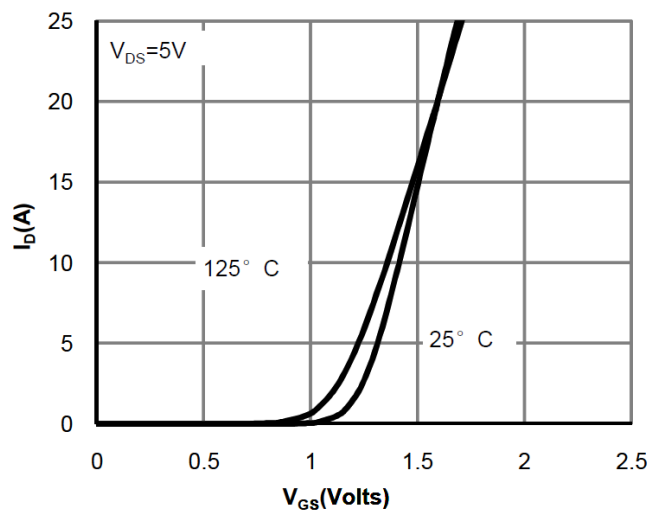


Figure 2: Transfer Characteristics

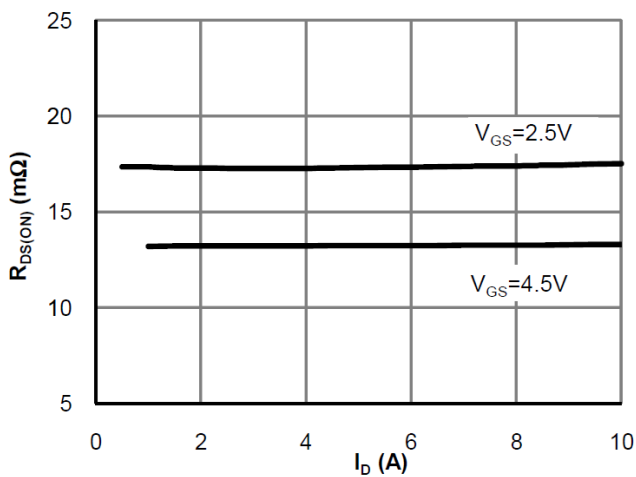


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

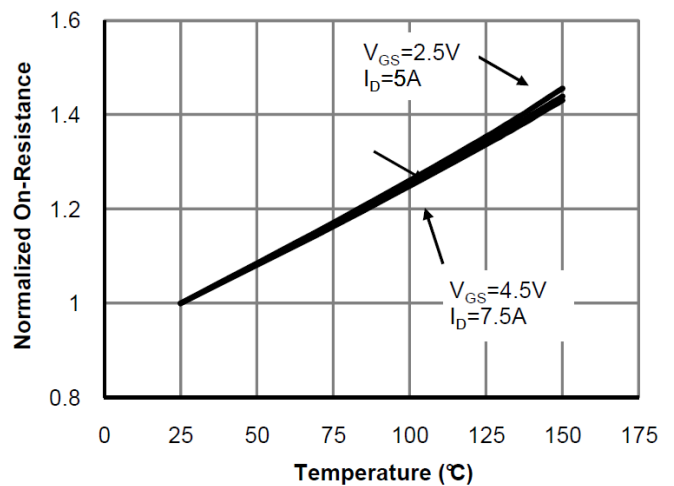


Figure 4: On-Resistance vs. Junction Temperature

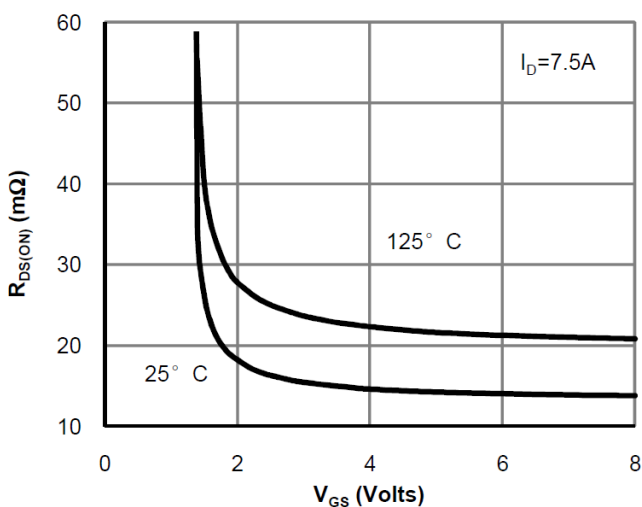


Figure 5: On-Resistance vs. Gate-Source Voltage

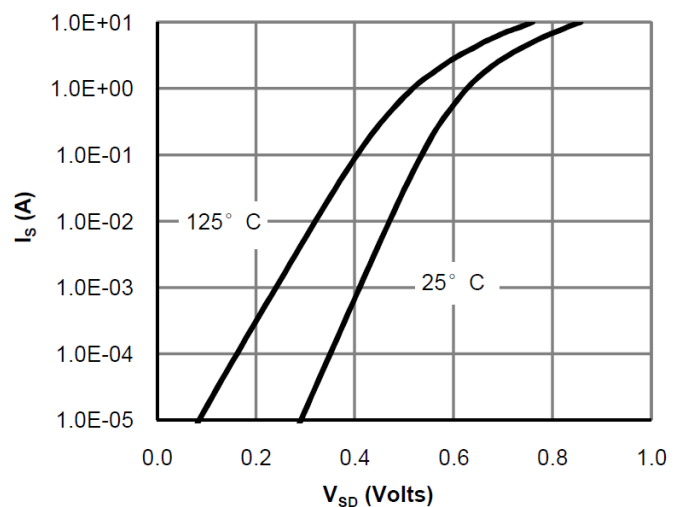
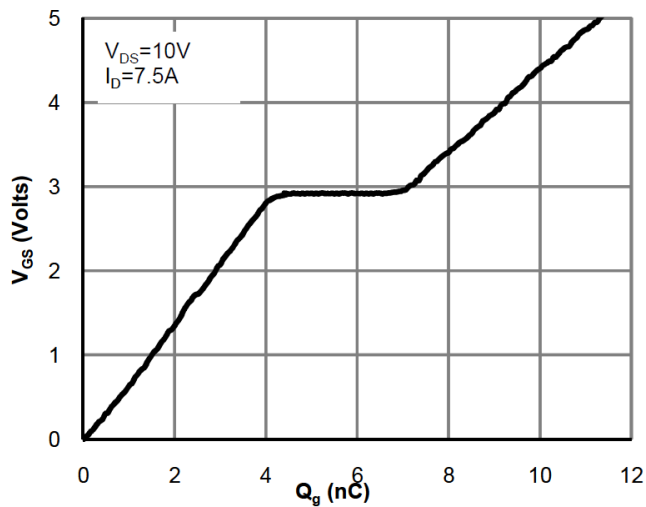
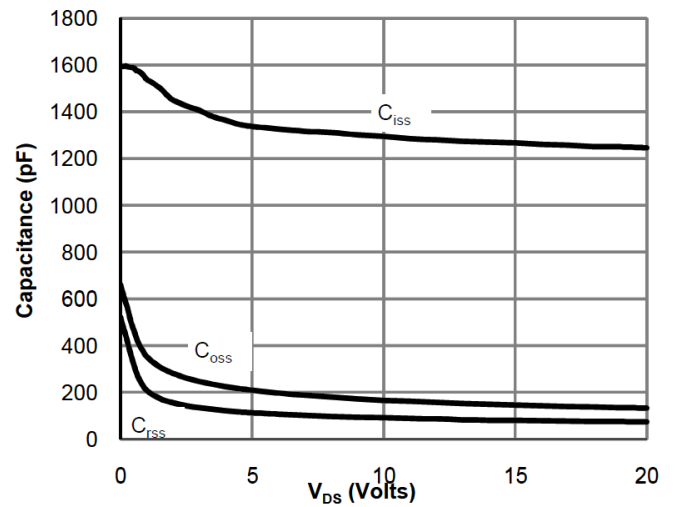


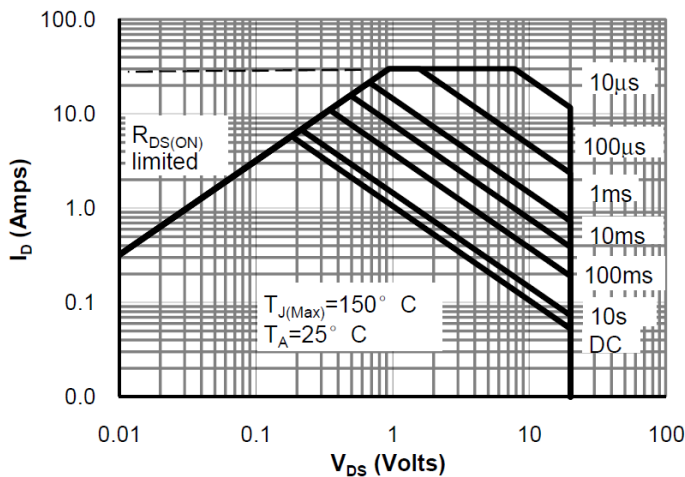
Figure 6: Body-Diode Characteristics



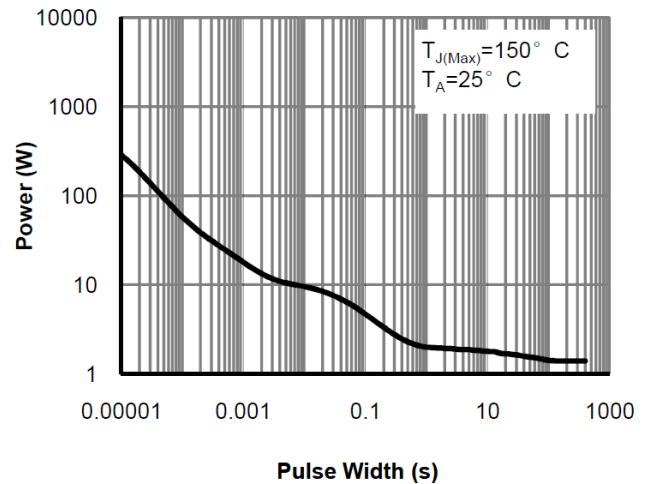
**Figure 7: Gate-Charge Characteristics**



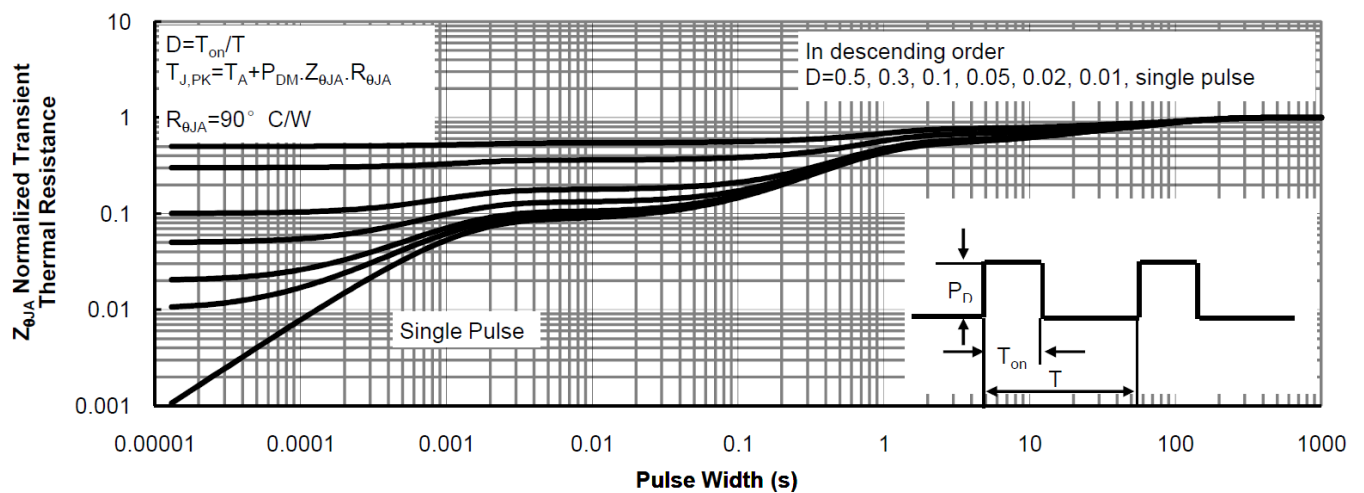
**Figure 8: Capacitance Characteristics**



**Figure 9: Maximum Forward Biased Safe Operating Area**

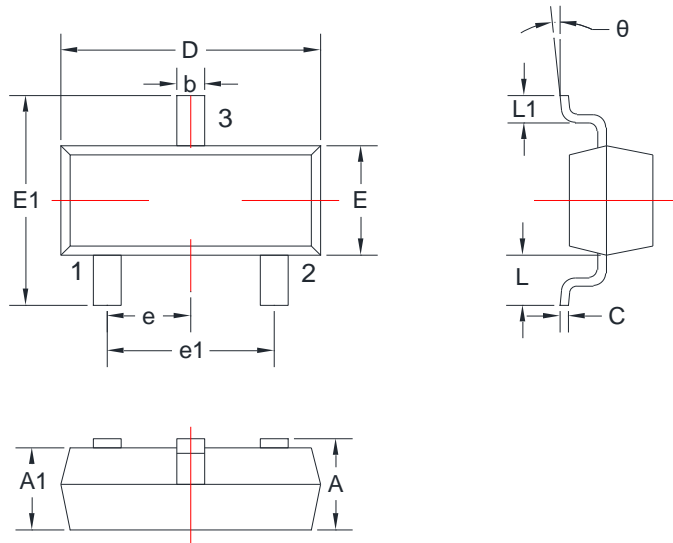


**Figure 10: Single Pulse Power Rating Junction-to-Ambient**



**Figure 11: Normalized Maximum Transient Thermal Impedance**

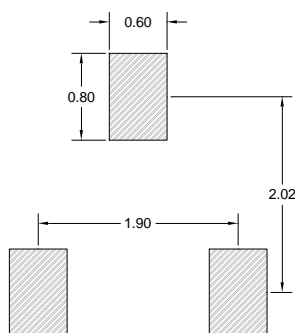
**8. Dimension (SOT-23)**



Units: mm

| Symbol | Dimensions |       | Symbol   | Dimensions |       |
|--------|------------|-------|----------|------------|-------|
|        | Min.       | Max.  |          | Min.       | Max.  |
| A      | 0.900      | 1.150 | E1       | 2.250      | 2.550 |
| A1     | 0.900      | 1.050 | e        | 0.950TYP   |       |
| b      | 0.300      | 0.500 | e1       | 1.800      | 2.000 |
| c      | 0.080      | 0.150 | L        | 0.550REF   |       |
| D      | 2.800      | 3.00  | L1       | 0.300      | 0.500 |
| E      | 1.200      | 1.400 | $\theta$ | 0°         | 8°    |

**Recommended Land Pattern**



**Note:**

1. Controlling dimension: in millimeters
2. General tolerance:  $\pm 0.05\text{mm}$
3. The pad layout is for reference only

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