

## Features

- Proprietary  $\alpha$ SiC MOSFET technology
- Low loss, with low  $R_{DS, ON}$
- Fast switching with low  $R_G$  and low capacitance
- Optimized gate drive voltage ( $V_{GS} = 15V$ )
- Low reverse recovery diode ( $Q_{rr}$ )
- AEC-Q101 Automotive Qualified

## Product Summary

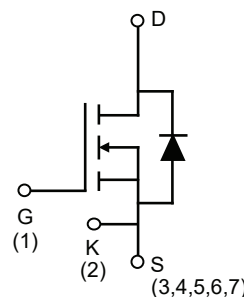
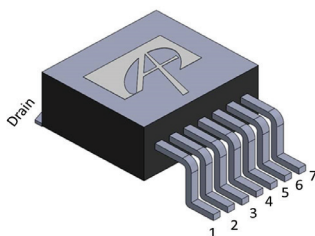
|                       |               |
|-----------------------|---------------|
| $V_{DS} @ T_{J, max}$ | 1200V         |
| $I_{DM}$              | 40A           |
| $R_{DS(ON), typ}$     | 150m $\Omega$ |
| $Q_{rr}$              | 73nC          |
| $E_{OSS} @ 800V$      | 18 $\mu$ J    |
| 100% UIS Tested       |               |

## Applications

- xEV Charger
- Electric Vehicle Supply Equipment (EVSE)
- Motor Drives
- Automotive Inverters



## Pin Configuration



| Ordering Part Number | Package Type | Form        | Shipping Quantity |
|----------------------|--------------|-------------|-------------------|
| AOBB150V120X2Q       | TO-263-7L    | Tape & Reel | 800/Reel          |

## Absolute Maximum Ratings

( $T_A = 25^\circ\text{C}$ , unless otherwise noted)

| Symbol              | Parameter                                                                    |                                      | AOBB150V120X2Q | Units            |
|---------------------|------------------------------------------------------------------------------|--------------------------------------|----------------|------------------|
| $V_{DS}$            | Drain-Source Voltage                                                         |                                      | 1200           | V                |
| $V_{GS, MAX}$       | Gate-Source Voltage                                                          | Maximum                              | -8/+18         | V                |
| $V_{GS, OP, TRANS}$ |                                                                              | Max Transient <sup>(A)</sup>         | -8/+20         |                  |
| $V_{GS, OP}$        |                                                                              | Recommended Operating <sup>(B)</sup> | -5/+15         |                  |
| $I_D$               | Continuous Drain Current                                                     | $T_C = 25^\circ\text{C}$             | 19             | A                |
|                     |                                                                              | $T_C = 100^\circ\text{C}$            | 13             |                  |
| $I_{DM}$            | Pulsed Drain Current <sup>(C)</sup>                                          |                                      | 40             |                  |
| $I_{SD}$            | Continuous Body Diode Forward Current ( $V_{GS} = -5V$ )                     |                                      | 21             |                  |
| $E_{AS}$            | Single Pulsed Avalanche Energy <sup>(D)</sup>                                |                                      | 90             | mJ               |
| $P_D$               | Power Dissipation <sup>(C)</sup>                                             | $T_C = 25^\circ\text{C}$             | 107            | W                |
| $T_J, T_{STG}$      | Junction and Storage Temperature Range                                       |                                      | -55 to 175     | $^\circ\text{C}$ |
| $T_L$               | Maximum lead temperature for soldering purpose, 1/8" from case for 5 seconds |                                      | 245            | $^\circ\text{C}$ |

## Thermal Characteristics

| Symbol           | Parameter                                    | Typ | Max | Units |
|------------------|----------------------------------------------|-----|-----|-------|
| R <sub>θJA</sub> | Maximum Junction-to-Ambient <sup>(E,F)</sup> |     | 40  | °C/W  |
| R <sub>θJC</sub> | Maximum Junction-to-Case <sup>(G)</sup>      | 1.2 | 1.4 | °C/W  |

## Electrical Characteristics

(T<sub>J</sub> = 25°C, unless otherwise noted)

| Symbol                      | Parameter                          | Conditions                                                                                                                                                             | Min  | Typ  | Max  | Units |
|-----------------------------|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|-------|
| <b>STATIC PARAMETERS</b>    |                                    |                                                                                                                                                                        |      |      |      |       |
| BV <sub>DSS</sub>           | Drain-Source Breakdown Voltage     | I <sub>D</sub> = 250 μA, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 25°C                                                                                                  | 1200 |      |      | V     |
|                             |                                    | I <sub>D</sub> = 250 μA, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 150°C                                                                                                 | 1200 |      |      |       |
| I <sub>DSS</sub>            | Zero Gate Voltage Drain Current    | V <sub>DS</sub> = 1200 V, V <sub>GS</sub> = 0 V                                                                                                                        |      |      | 100  | μA    |
| I <sub>GSS</sub>            | Gate-Body Leakage Current          | V <sub>DS</sub> = 0 V, V <sub>GS</sub> = +15/-5 V                                                                                                                      |      |      | ±100 | nA    |
| V <sub>GS(th)</sub>         | Gate Threshold Voltage             | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 3.9 mA                                                                                                            | 1.7  | 2.8  | 3.8  | V     |
| R <sub>DS(ON)</sub>         | Static Drain-Source On-resistance  | V <sub>GS</sub> = 15 V, I <sub>D</sub> = 3.9 A                                                                                                                         |      | 150  | 195  | mΩ    |
|                             |                                    | T <sub>J</sub> = 25°C                                                                                                                                                  |      | 210  |      |       |
|                             |                                    | T <sub>J</sub> = 150°C                                                                                                                                                 |      |      |      |       |
| g <sub>FS</sub>             | Forward Transconductance           | V <sub>DS</sub> = 20 V, I <sub>D</sub> = 3.9 A                                                                                                                         |      | 5.7  |      | S     |
| V <sub>SD</sub>             | Diode Forward Voltage              | I <sub>S</sub> = 3.9 A, V <sub>GS</sub> = -5 V                                                                                                                         |      | 4    | 5    | V     |
| <b>DYNAMIC PARAMETERS</b>   |                                    |                                                                                                                                                                        |      |      |      |       |
| C <sub>iss</sub>            | Input Capacitance                  | V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 800 V, f = 1 MHz                                                                                                              |      | 664  |      | pF    |
| C <sub>oss</sub>            | Output Capacitance                 |                                                                                                                                                                        |      | 42.2 |      | pF    |
| C <sub>rss</sub>            | Reverse Transfer Capacitance       |                                                                                                                                                                        |      | 5.2  |      | pF    |
| E <sub>oss</sub>            | C <sub>oss</sub> Stored Energy     |                                                                                                                                                                        |      | 18   |      | μJ    |
| R <sub>G</sub>              | Gate Resistance                    | f = 1 MHz                                                                                                                                                              | 1.2  | 2.1  | 3.2  | Ω     |
| <b>SWITCHING PARAMETERS</b> |                                    |                                                                                                                                                                        |      |      |      |       |
| Q <sub>g</sub>              | Total Gate Charge                  | V <sub>GS</sub> = -5/+15 V, V <sub>DS</sub> = 800 V, I <sub>D</sub> = 3.9 A                                                                                            |      | 27.9 |      | nC    |
| Q <sub>gs</sub>             | Gate Source Charge                 |                                                                                                                                                                        |      | 8.9  |      | nC    |
| Q <sub>gd</sub>             | Gate Drain Charge                  |                                                                                                                                                                        |      | 14.3 |      | nC    |
| t <sub>D(on)</sub>          | Turn-on Delay Time                 | V <sub>GS</sub> = -5 V/+15 V, V <sub>DS</sub> = 800 V,<br>I <sub>D</sub> = 9 A, R <sub>G,ON</sub> = 2 Ω, R <sub>G,OFF</sub> = 0 Ω<br>L = 120 μH<br>FWD: AOBB150V120X2Q |      | 5.5  |      | ns    |
| t <sub>r</sub>              | Turn-on Rise Time                  |                                                                                                                                                                        |      | 5.7  |      | ns    |
| t <sub>D(off)</sub>         | Turn-off Delay Time                |                                                                                                                                                                        |      | 8.5  |      | ns    |
| t <sub>f</sub>              | Turn-off Fall Time                 |                                                                                                                                                                        |      | 18.3 |      | ns    |
| E <sub>on</sub>             | Turn-on Energy                     |                                                                                                                                                                        |      | 88   |      | μJ    |
| E <sub>off</sub>            | Turn-off Energy                    |                                                                                                                                                                        |      | 16   |      | μJ    |
| E <sub>tot</sub>            | Total Switching Energy             |                                                                                                                                                                        |      | 104  |      | μJ    |
| t <sub>rr</sub>             | Body Diode Reverse Recovery Time   | I <sub>F</sub> = 9 A, dI/dt = 1000 A/μs, V <sub>DS</sub> = 800 V                                                                                                       |      | 25   |      | ns    |
| I <sub>rm</sub>             | Peak Reverse Recovery Current      |                                                                                                                                                                        |      | 5.5  |      | A     |
| Q <sub>rr</sub>             | Body Diode Reverse Recovery Charge |                                                                                                                                                                        |      | 73   |      | nC    |

### Notes:

- A. t<sub>pulse</sub> < 1 μs, f > 1 Hz
- B. Device can be operated at V<sub>GS</sub> = 0/15 V. Actual operating V<sub>GS</sub> will depend on application specifics such as parasitic inductance and dV/dt but should not exceed maximum ratings.
- C. The power dissipation P<sub>D</sub> is based on T<sub>J(MAX)</sub> = 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 = 5 mH, I<sub>AS</sub> = 6 A, R<sub>G</sub> = 25 Ω, Starting T<sub>J</sub> = 25°C.
- E. The value of R<sub>θJA</sub> is measured with the device in a still air environment with T<sub>A</sub> = 25°C.

- F. The R<sub>θJA</sub> is the sum of the thermal impedance from junction to case R<sub>θJC</sub> and case to ambient.
- G. The value of R<sub>θJC</sub> is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of T<sub>J(MAX)</sub> = 175°C.
- H. The static characteristics in Figures 1 to 8 are obtained using < 300 μs pulses, duty cycle 0.5% max.
- I. These curves are based on R<sub>θJC</sub> which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of T<sub>J(MAX)</sub> = 175°C. The SOA curve provides a single pulse rating.

## Typical Electrical and Thermal Characteristics

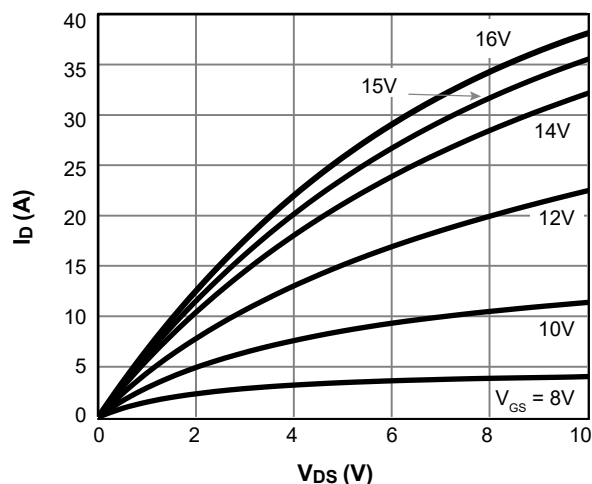


Figure 1. On-Region Characteristics  $T_J = 25^\circ\text{C}$

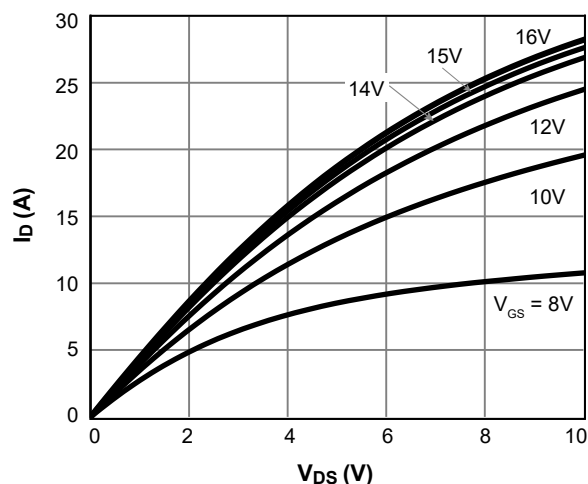


Figure 2. On-Region Characteristics  $T_J = 175^\circ\text{C}$

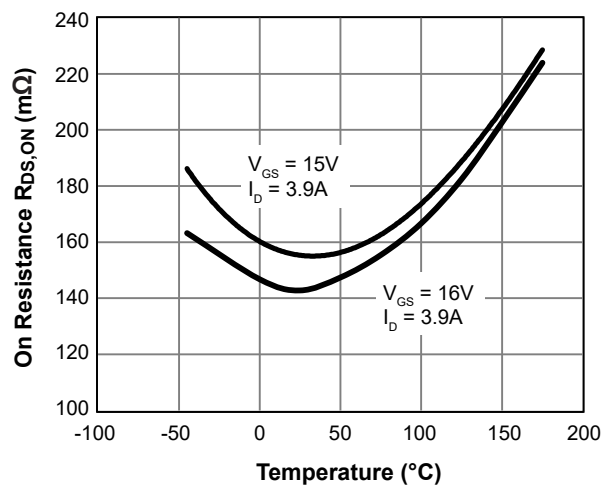


Figure 3. On Resistance vs. Junction Temperature

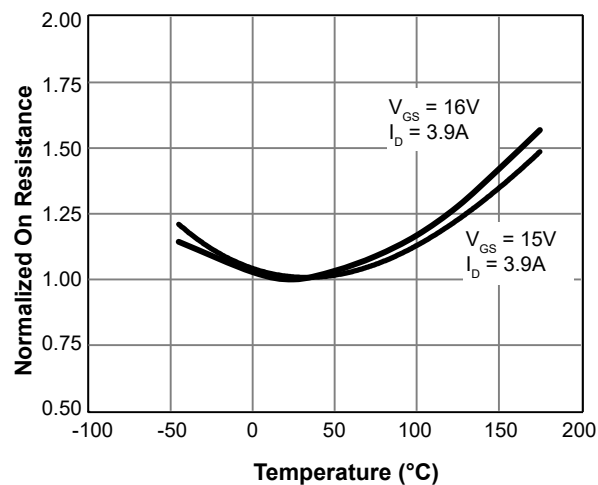


Figure 4. Normalized On Resistance vs. Junction Temperature

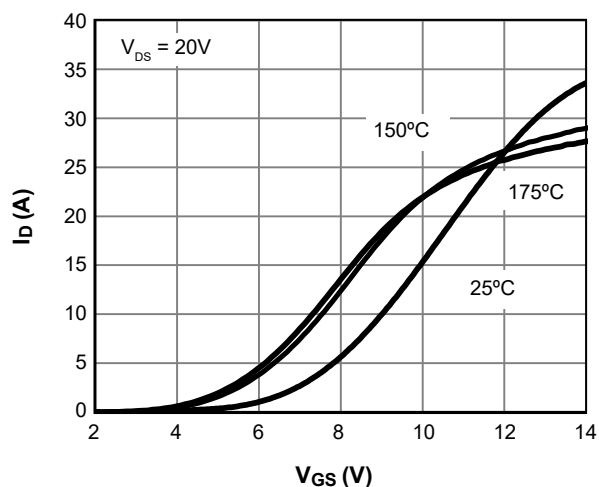


Figure 5. Transfer Characteristics

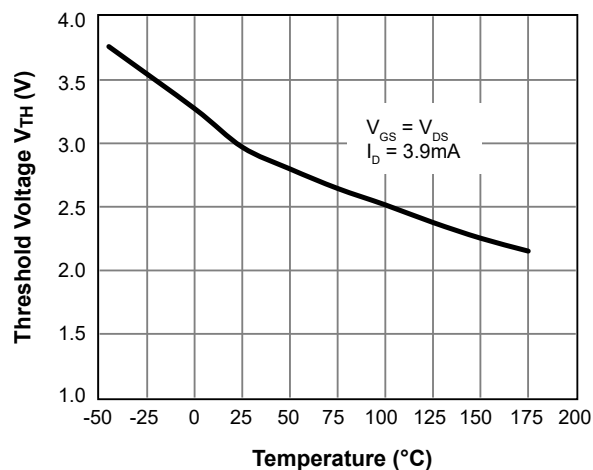


Figure 6. Threshold Voltage vs. Junction Temperature

## Typical Electrical and Thermal Characteristics (Continued)

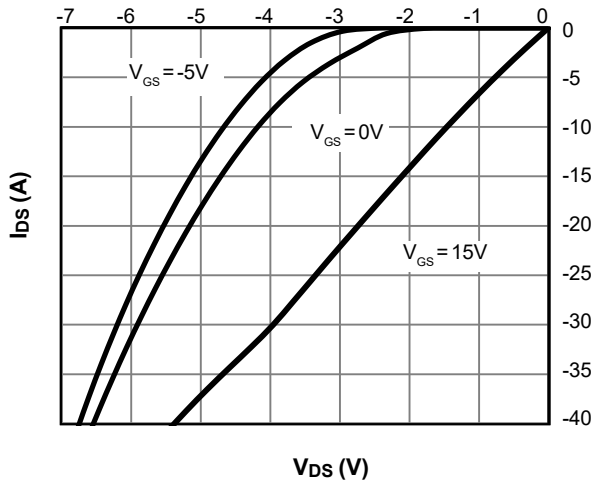


Figure 7. Body-diode Characteristics at 25°C

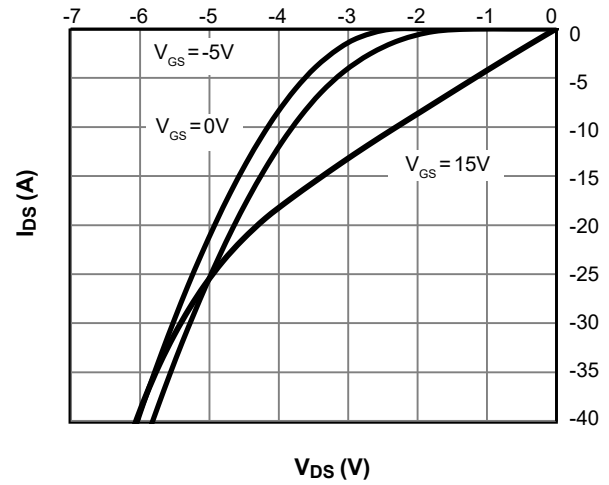


Figure 8. Body-diode Characteristics at 175°C

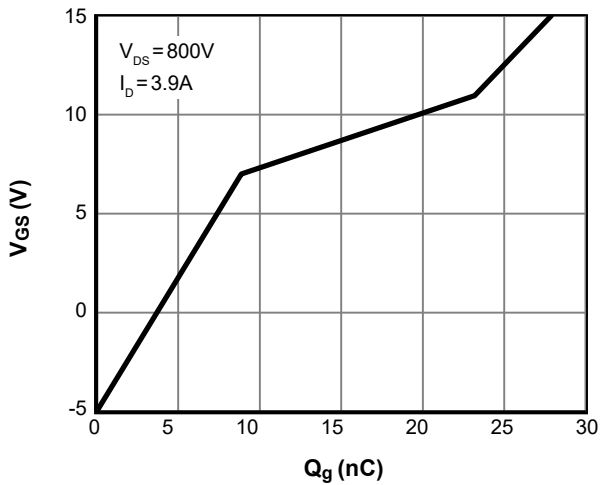


Figure 9. Gate-charge Characteristics

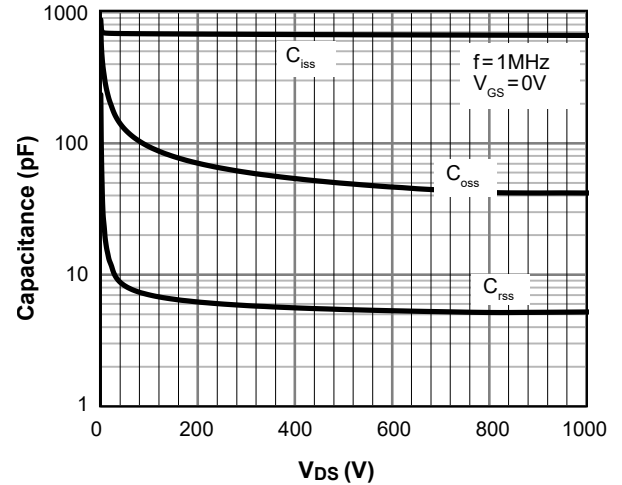


Figure 10. Capacitance Characteristics

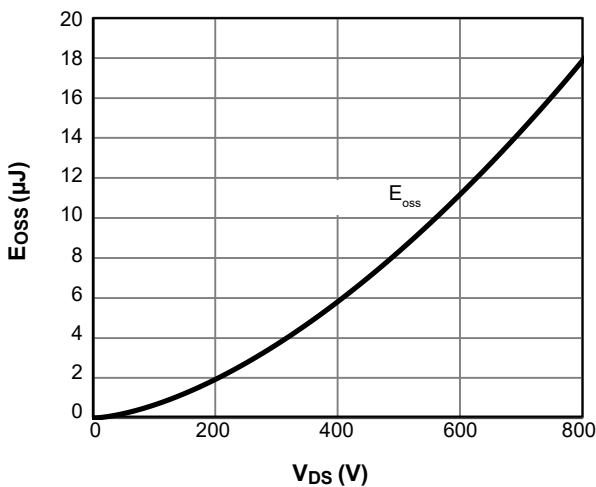


Figure 11. Coss Stored Energy

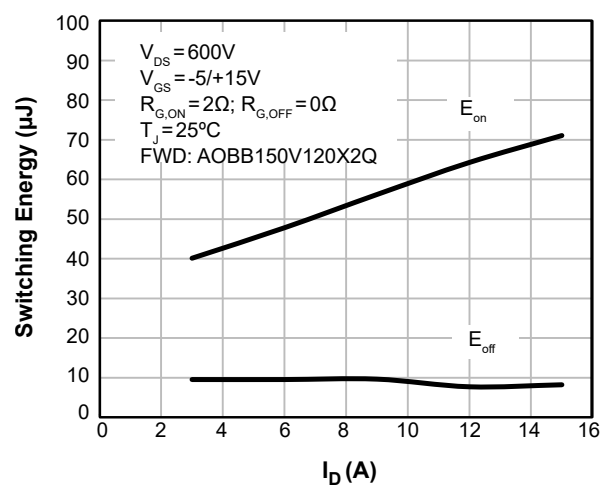


Figure 12. Switching Energy vs. Drain Current

## Typical Electrical and Thermal Characteristics (Continued)

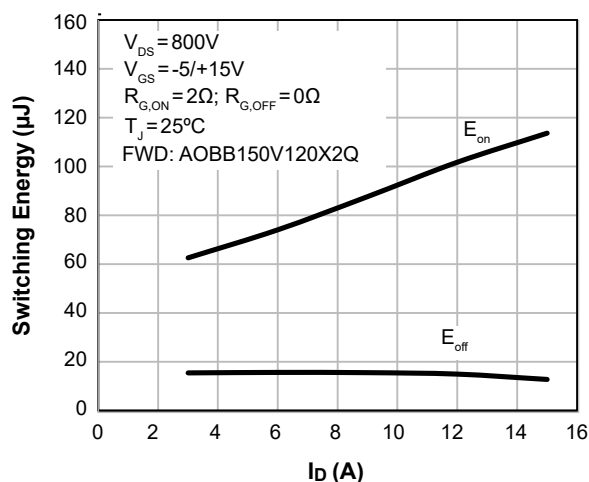


Figure 13. Switching Energy vs. Drain Current

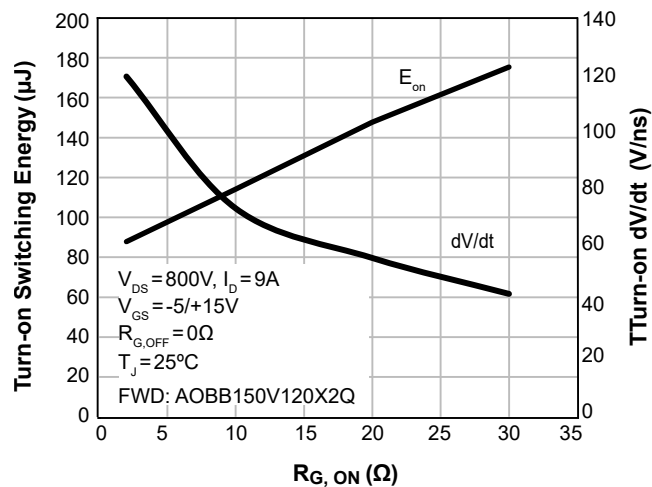


Figure 14. Turn-on Energy and dV/dt vs. External Gate Resistance

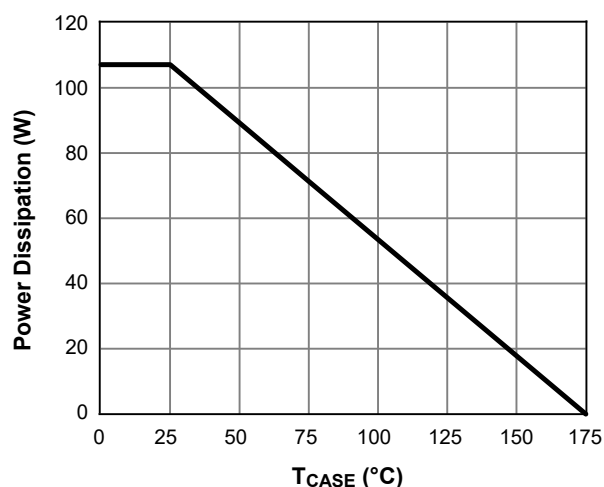


Figure 15. Power De-rating (Note I)

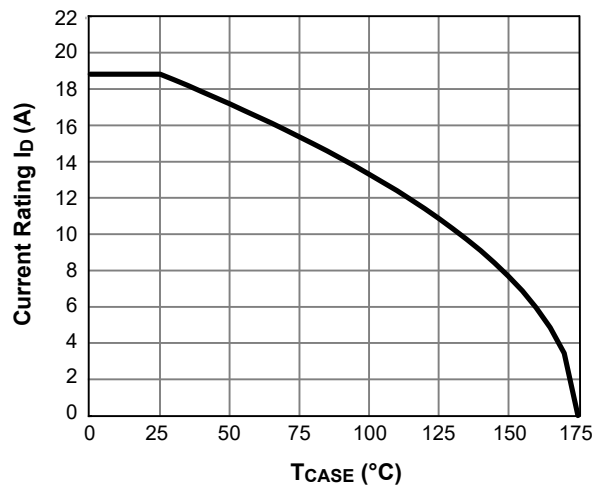


Figure 16. Current De-rating (Note I)

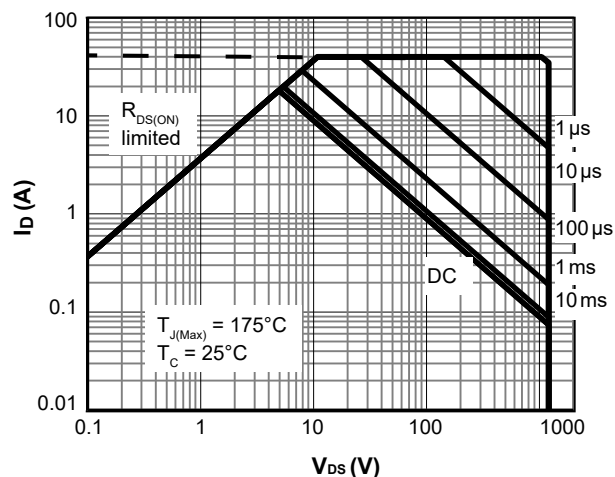


Figure 17. Maximum Forward Biased Safe Operating Area for AOBB150V120X2Q (Note I)

# Typical Characteristics and Thermal Characteristics (Continued)

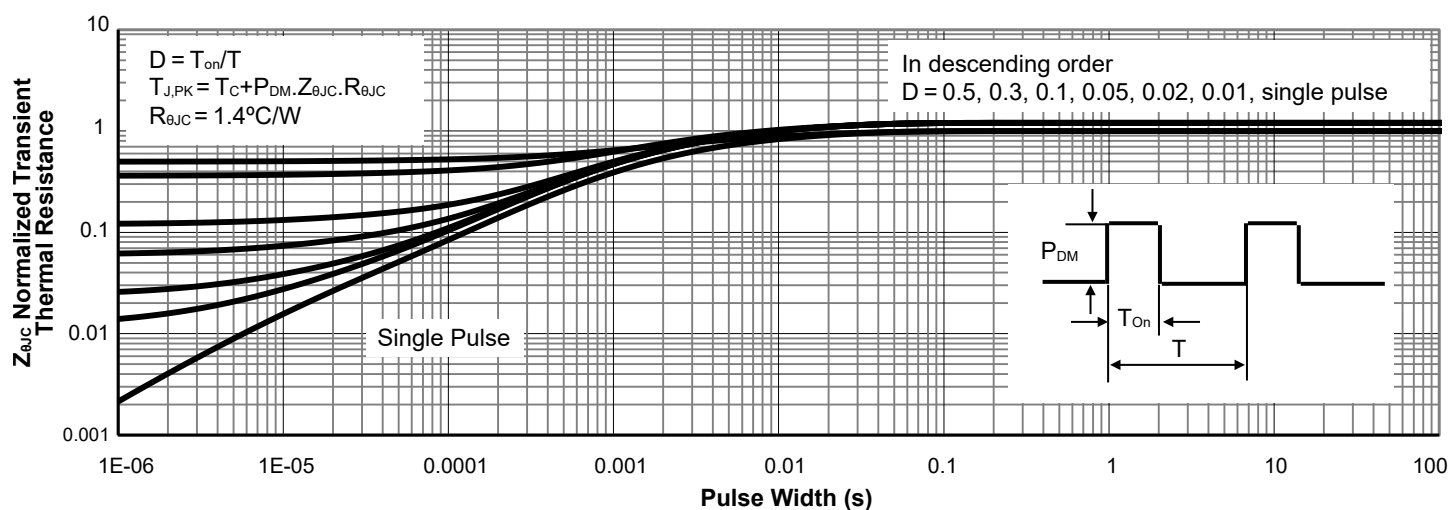
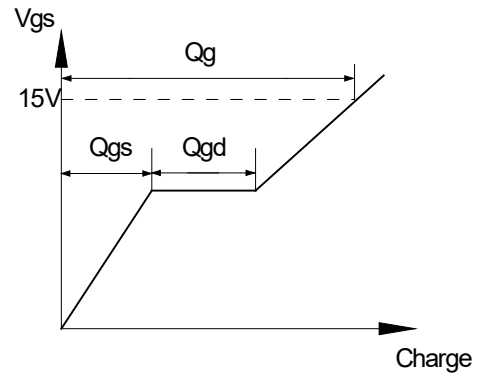
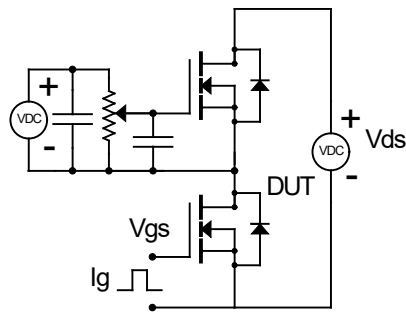
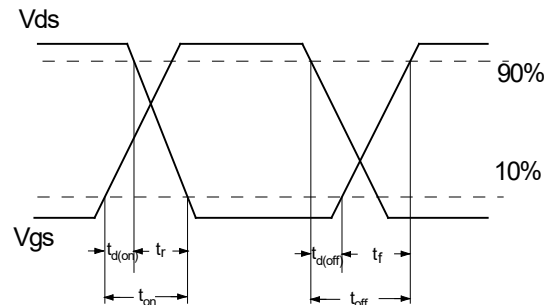
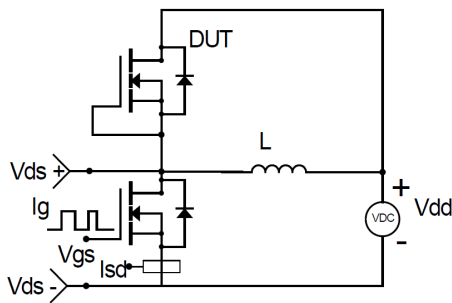


Figure 18. Normalized Maximum Transient Thermal Impedance for AOBB150V120X2Q (Note I)

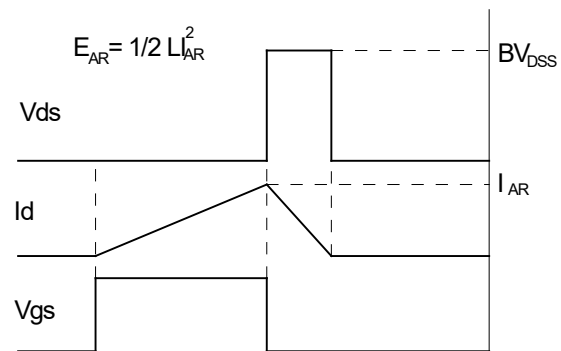
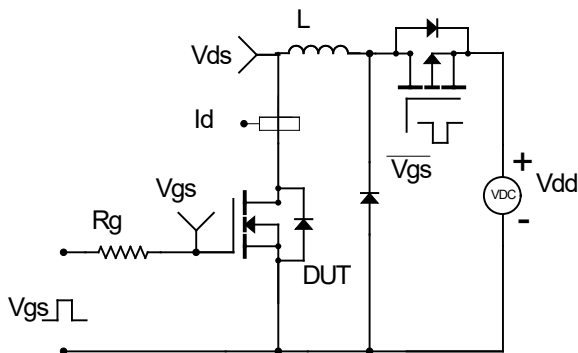
## Test Circuits and Waveforms



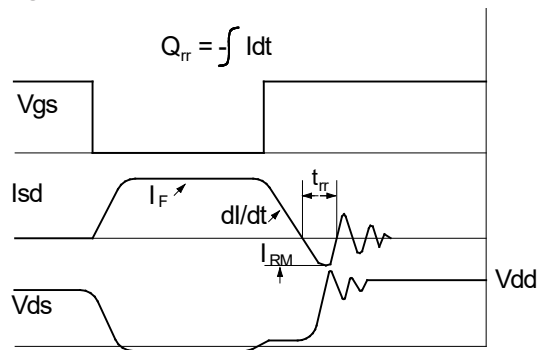
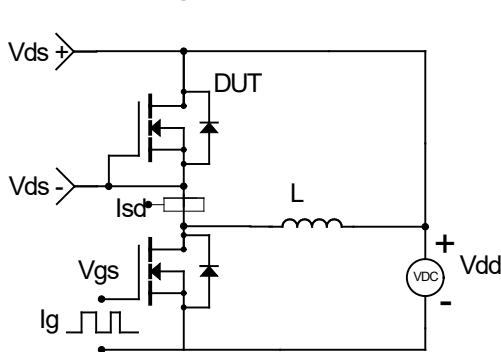
**Figure 19. Gate Charge Test Circuits and Waveforms**



**Figure 20. Inductive Switching Test Circuit and Waveforms**

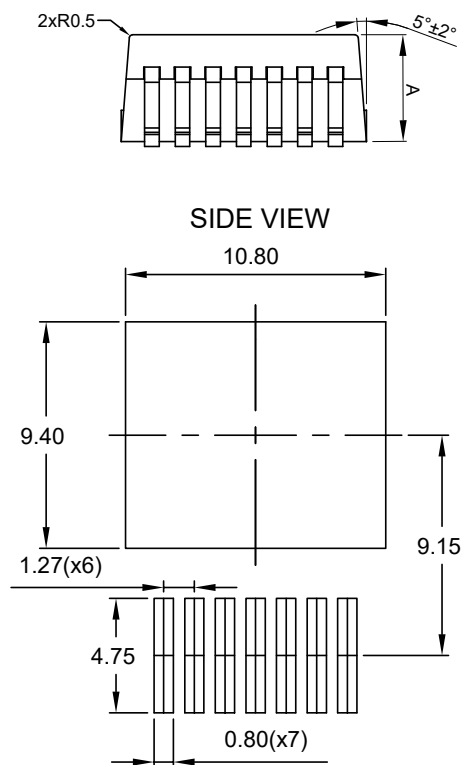
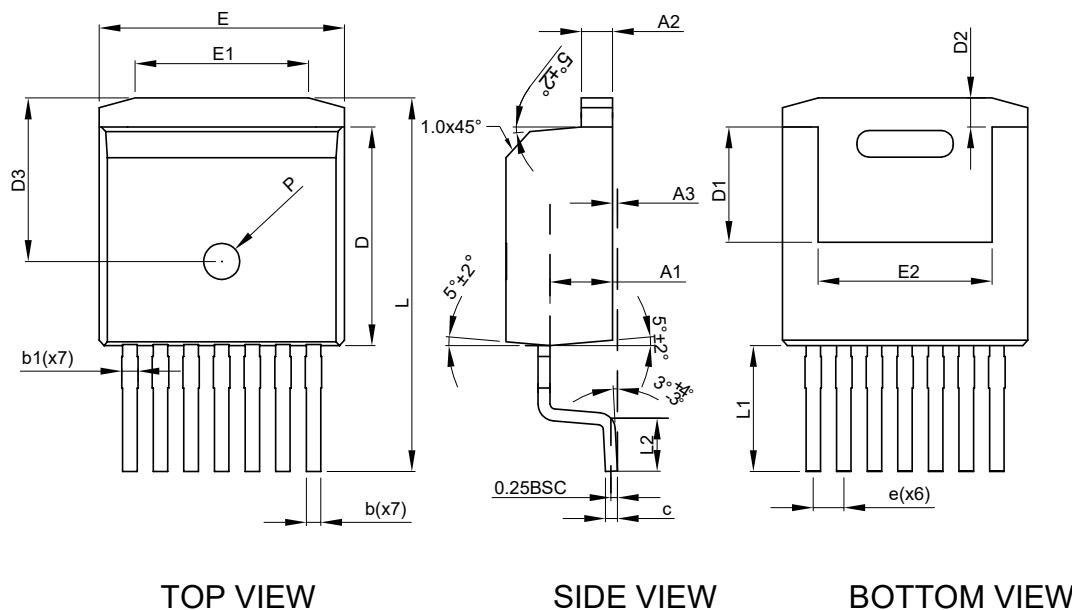


**Figure 21. Unclamped Inductive Switching (UIS) Test Circuit and Waveforms**



**Figure 22. Diode Recovery Test Circuits and Waveforms**

## Package Dimensions, TO-263-7L



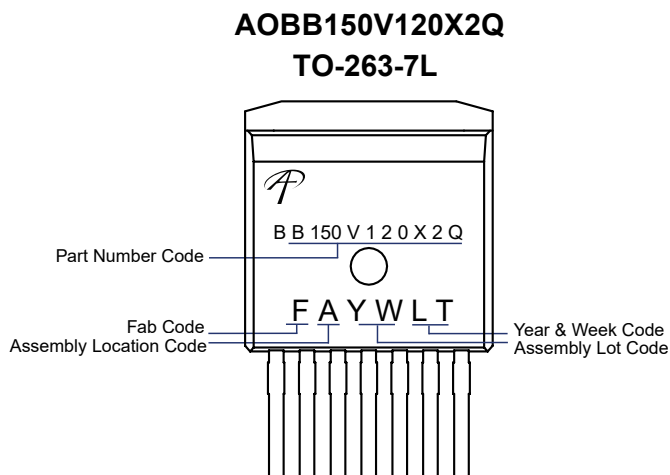
| SYMBOLS | DIM. IN MM |       |       | DIM. IN INCH |       |       |
|---------|------------|-------|-------|--------------|-------|-------|
|         | MIN.       | NOM.  | MAX.  | MIN.         | NOM.  | MAX.  |
| A       | 4.30       | 4.43  | 4.56  | 0.169        | 0.174 | 0.180 |
| A1      | 2.45       | 2.60  | 2.75  | 0.096        | 0.102 | 0.108 |
| A2      | 1.20       | 1.30  | 1.40  | 0.047        | 0.051 | 0.055 |
| A3      | 0.00       | 0.13  | 0.25  | 0.000        | 0.005 | 0.010 |
| b       | 0.50       | 0.60  | 0.70  | 0.020        | 0.024 | 0.028 |
| b1      | 0.60       | 0.70  | 0.90  | 0.024        | 0.028 | 0.035 |
| c       | 0.45       | 0.50  | 0.60  | 0.018        | 0.020 | 0.024 |
| D       | 8.93       | 9.08  | 9.23  | 0.352        | 0.357 | 0.363 |
| D1      | 4.65       | 4.80  | 4.95  | 0.183        | 0.189 | 0.195 |
| D2      | 0.98       | 1.20  | 1.42  | 0.039        | 0.047 | 0.056 |
| D3      | 6.48       | 6.78  | 7.08  | 0.255        | 0.267 | 0.279 |
| E       | 10.08      | 10.18 | 10.28 | 0.397        | 0.401 | 0.405 |
| E1      | 6.50       | 7.00  | 7.50  | 0.256        | 0.276 | 0.295 |
| E2      | 6.92       | 7.22  | 7.52  | 0.272        | 0.284 | 0.296 |
| e       | 1.27BSC    |       |       | 0.05BSC      |       |       |
| L       | 15.00      | 15.50 | 16.00 | 0.591        | 0.610 | 0.630 |
| L1      | 5.09       | 5.22  | 5.33  | 0.200        | 0.206 | 0.210 |
| L2      | 1.90       | 2.20  | 2.50  | 0.075        | 0.087 | 0.098 |
| P       | 1.40       | 1.50  | 1.60  | 0.055        | 0.059 | 0.063 |

**NOTE:**

1. CONTROLLING DIMENSION IS MILLIMETER.  
CONVERTED INCH DIMENSIONS ARE NOT NECESSARILY EXACT.
2. DOTTED OUTLINE IS GUIDELINE TO BE COMPATIBLE WITH  
INDUSTRY COMMON LAYOUT BUT NOT RECOMMENDED BY AOS.



## Part Marking



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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.