

### Product Summary

| $V_{(BR)DSS}$ | $R_{DS(on)MAX}$ | $I_D@25^{\circ}C$ |
|---------------|-----------------|-------------------|
| 1200V         | 38mΩ@18V        | 83A               |

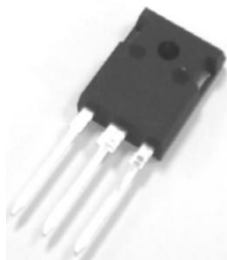
### Feature

- Wide bandgap SiC MOSFET technology
- Low On-Resistance with High Blocking Voltage
- Low Capacitances with High-Speed switching
- Low reverse recovery(Qrr)

### Application

- Switch Mode Power Supplies
- Renewable Energy
- Motor Drives
- High Voltage DC/DC Converters

### Package

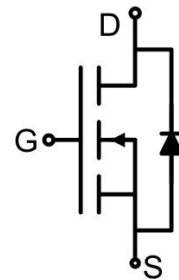


TO-247-3L

### Marking



### Circuit diagram



### Absolute maximum ratings ( $T_C=25^{\circ}C$ unless otherwise noted)

| Parameter                | Symbol          | Test Condition                                 | Value     | Unit          |
|--------------------------|-----------------|------------------------------------------------|-----------|---------------|
| Drain-Source Voltage     | $V_{DS}$        | $V_{GS}=0V, I_D=100\mu A$                      | 1200      | V             |
| Gate-Source Voltage      | $V_{GSmax}$     | $t_p \leq 500ns, \text{ duty cycle } \leq 1\%$ | -8/+20    | V             |
| Gate-Source Voltage      | $V_{GSOP}$      | Static                                         | -4/+18    | V             |
| Continuous Drain Current | $I_D$           | $V_{GS}=18V$                                   | 83        | A             |
|                          | $I_D$           | $V_{GS}=18V, T_C=100^{\circ}C$                 | 59        | A             |
| Pulsed Drain Current     | $I_{D,pulse}$   | Pulse with $t_p$ limited by $T_{Jmax}$         | 165       | A             |
| Power Dissipation        | $P_D$           | $T_J=175^{\circ}C$                             | 341       | W             |
| Thermal Resistance (Typ) | $R_{\theta JC}$ | Junction-to-Case                               | 0.44      | $^{\circ}C/W$ |
| Junction Temperature     | $T_J$           |                                                | -55~ +175 | $^{\circ}C$   |
| Storage Temperature      | $T_{STG}$       |                                                | -55~ +175 | $^{\circ}C$   |

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

| Parameter                          | Symbol               | Test Condition                                                                                         | Min. | Typ. | Max. | Unit |
|------------------------------------|----------------------|--------------------------------------------------------------------------------------------------------|------|------|------|------|
| Static Characteristics             |                      |                                                                                                        |      |      |      |      |
| Drain-source breakdown voltage     | V <sub>(BR)DSS</sub> | V <sub>GS</sub> =0V, I <sub>D</sub> =100μA                                                             | 1200 |      |      | V    |
| Zero gate voltage drain current    | I <sub>DSS</sub>     | V <sub>DS</sub> =1200V,V <sub>GS</sub> =0V                                                             |      | 1    | 50   | μA   |
| Gate-Source leakage current        | I <sub>GSS</sub>     | V <sub>GS</sub> =18V, V <sub>DS</sub> =0V                                                              |      |      | 250  | nA   |
| Gate threshold voltage             | V <sub>GS(th)</sub>  | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =14mA                                                |      | 2.6  |      | V    |
|                                    |                      | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =14mA,T <sub>J</sub> = 175°C                         |      | 1.8  |      |      |
| Drain-source on-resistance         | R <sub>DS(on)</sub>  | V <sub>GS</sub> =15V, I <sub>D</sub> =40A                                                              |      | 32   |      | mΩ   |
|                                    |                      | V <sub>GS</sub> =18V, I <sub>D</sub> =40A                                                              |      | 28   | 38   |      |
|                                    |                      | V <sub>GS</sub> =15V, I <sub>D</sub> =40A,T <sub>J</sub> = 175°C                                       |      | 55   |      |      |
|                                    |                      | V <sub>GS</sub> =18V, I <sub>D</sub> =40A,T <sub>J</sub> = 175°C                                       |      | 53   |      |      |
| Transconductance                   | g <sub>fs</sub>      | V <sub>GS</sub> =15V, I <sub>D</sub> =40A                                                              |      | 26   |      | S    |
|                                    |                      | V <sub>GS</sub> =15V, I <sub>D</sub> =40A,T <sub>J</sub> = 175°C                                       |      | 25   |      |      |
| Dynamic characteristics            |                      |                                                                                                        |      |      |      |      |
| Input Capacitance                  | C <sub>iss</sub>     | V <sub>DS</sub> =1000V,V <sub>GS</sub> =0V,f =100kHz<br>V <sub>AC</sub> = 25mV                         |      | 3708 |      | pF   |
| Output Capacitance                 | C <sub>oss</sub>     |                                                                                                        |      | 107  |      |      |
| Reverse Transfer Capacitance       | C <sub>rss</sub>     |                                                                                                        |      | 6.9  |      |      |
| Total Gate Charge                  | Q <sub>g</sub>       | V <sub>DS</sub> =800V,I <sub>D</sub> =40A<br>V <sub>GS</sub> =-4V/18V                                  |      | 66   |      | nC   |
| Gate-Source Charge                 | Q <sub>gs</sub>      |                                                                                                        |      | 32   |      |      |
| Gate-Drain Charge                  | Q <sub>gd</sub>      |                                                                                                        |      | 25   |      |      |
| Internal Gate Resistance           | R <sub>G(int)</sub>  | f=1 MHz, V <sub>AC</sub> =25mV                                                                         |      | 0.8  |      | Ω    |
| Turn-on delay time                 | t <sub>d(on)</sub>   | V <sub>DS</sub> =800V,V <sub>GS</sub> =-4/+18V,<br>I <sub>D</sub> =40A,R <sub>G(ext)</sub> =5Ω,L=200μH |      | 4    |      | nS   |
| Turn-on rise time                  | t <sub>r</sub>       |                                                                                                        |      | 35   |      |      |
| Turn-off delay time                | t <sub>d(off)</sub>  |                                                                                                        |      | 26   |      |      |
| Turn-off fall time                 | t <sub>f</sub>       |                                                                                                        |      | 8    |      |      |
| Turn-On Energy                     | E <sub>on</sub>      |                                                                                                        |      | 724  |      | μJ   |
| Turn-Off Energy                    | E <sub>off</sub>     |                                                                                                        |      | 138  |      |      |
| Total switching energy             | E <sub>tot</sub>     |                                                                                                        |      | 862  |      |      |
| Source-Drain Diode characteristics |                      |                                                                                                        |      |      |      |      |
| Diode Forward Current              | I <sub>S</sub>       | V <sub>GS</sub> =-4V,T <sub>C</sub> =25°C                                                              |      | 75   |      | A    |
| Diode Forward voltage              | V <sub>SD</sub>      | V <sub>GS</sub> =-4V, I <sub>SD</sub> =20A                                                             |      | 3.9  |      | V    |
|                                    |                      | V <sub>GS</sub> =-4V, I <sub>SD</sub> =20A,T <sub>J</sub> =175°C                                       |      | 3.5  |      |      |
| Reverse Recovery Time              | t <sub>rr</sub>      | V <sub>GS</sub> =-4V,I <sub>SD</sub> =40A,V <sub>R</sub> =800V<br>dif/dt =3400 A/μs                    |      | 27   |      | nS   |
| Reverse Recovery Charge            | Q <sub>rr</sub>      |                                                                                                        |      | 211  |      | nC   |
| Peak Reverse Recovery Current      | I <sub>rrm</sub>     |                                                                                                        |      | 14   |      | A    |

## Typical Characteristics

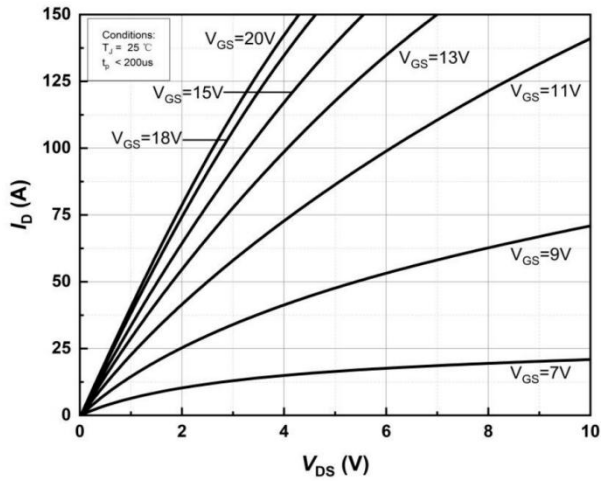


Figure 1. Output characteristics at  $T_j=25^\circ\text{C}$

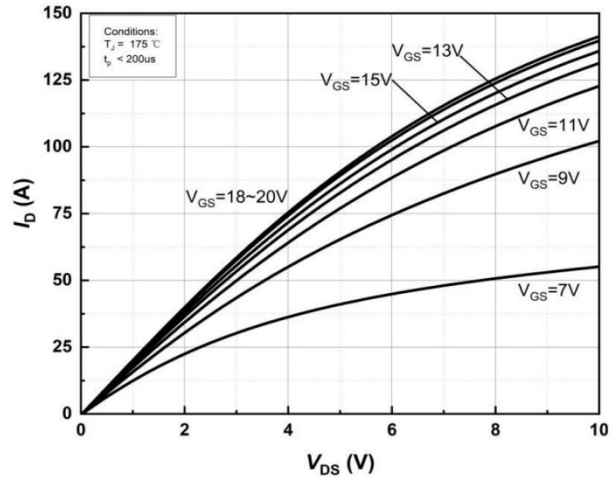


Figure 2. Output characteristics at  $T_j=175^\circ\text{C}$

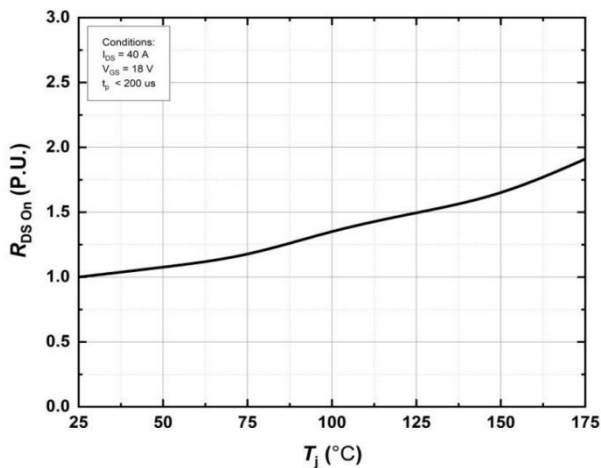


Figure 3. Normalized On-Resistance vs. Temperature

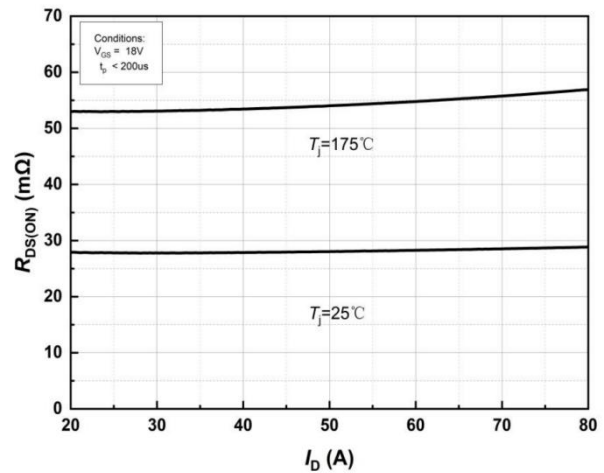


Figure 4. On-Resistance vs. Drain current for Various Temperature

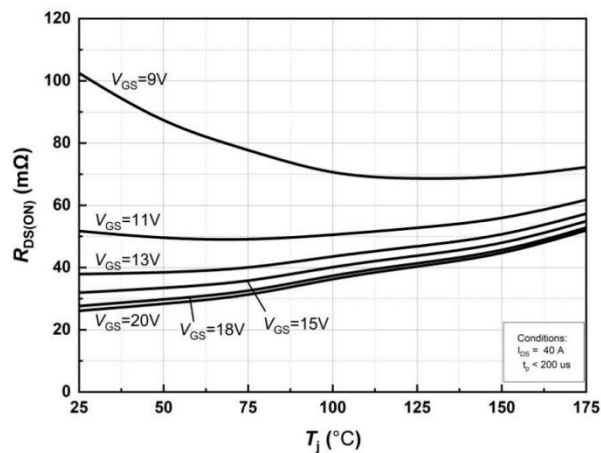


Figure 5. On-Resistance vs. Temperature for Various Gate Voltage

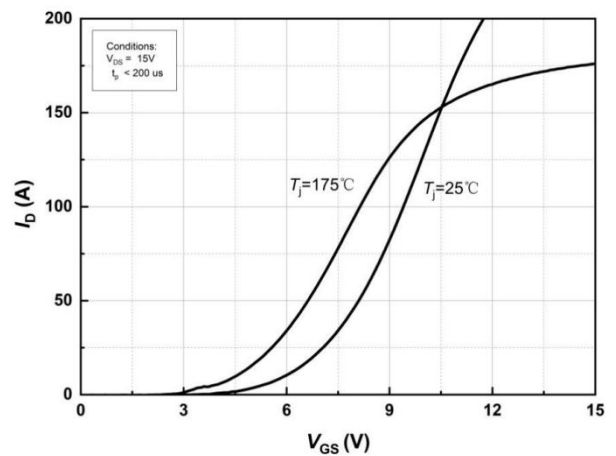


Figure 6. Transfer Characteristics for Various Junction Temperatures

### Typical Characteristics

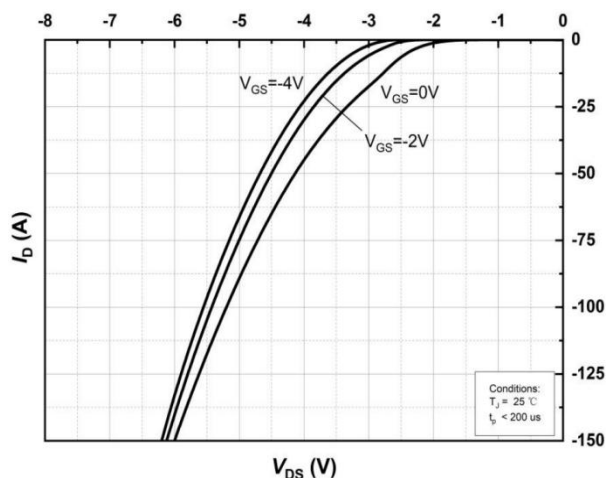


Figure 7. Body Diode Characteristics at  $T_j=25^{\circ}\text{C}$

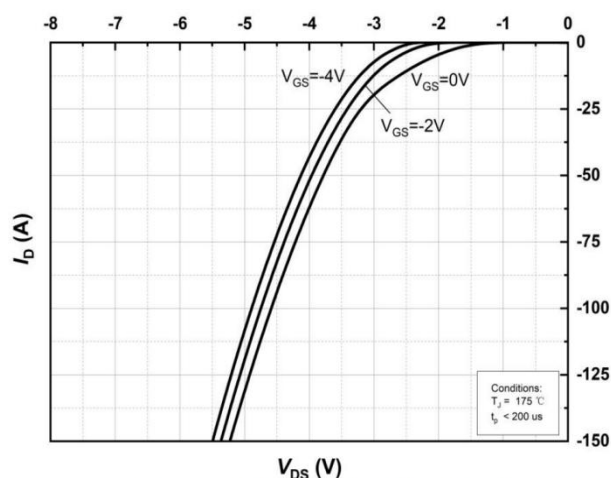


Figure 8. Body Diode Characteristics at  $T_j=175^{\circ}\text{C}$

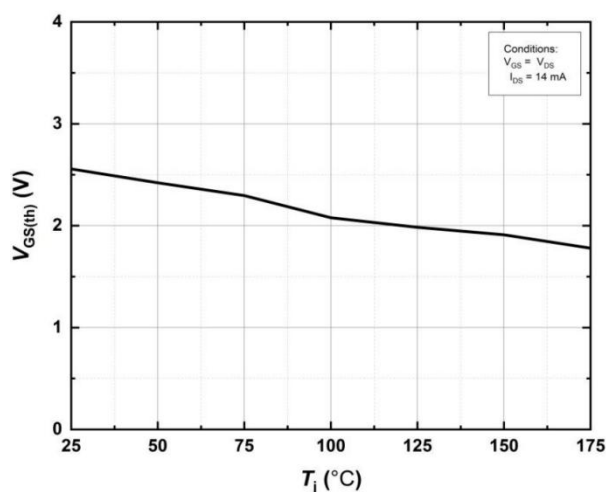


Figure 9. Threshold Voltage vs. Temperature

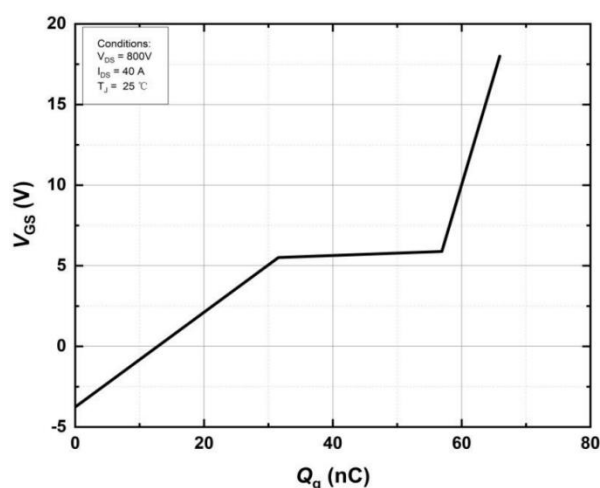


Figure 10 Gate Charge Characteristics

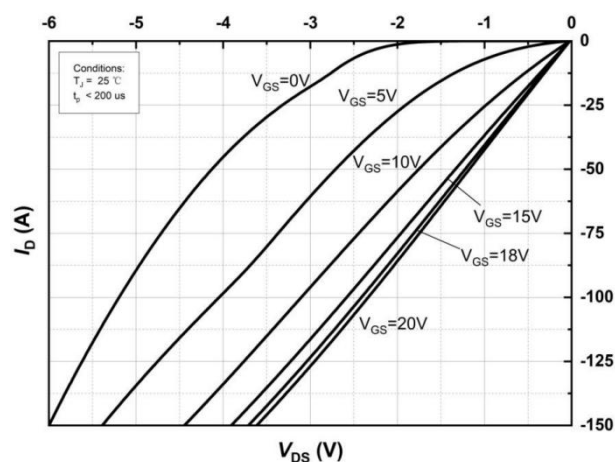


Figure 11. 3rd Quadrant Characteristic at  $T_j=25^{\circ}\text{C}$

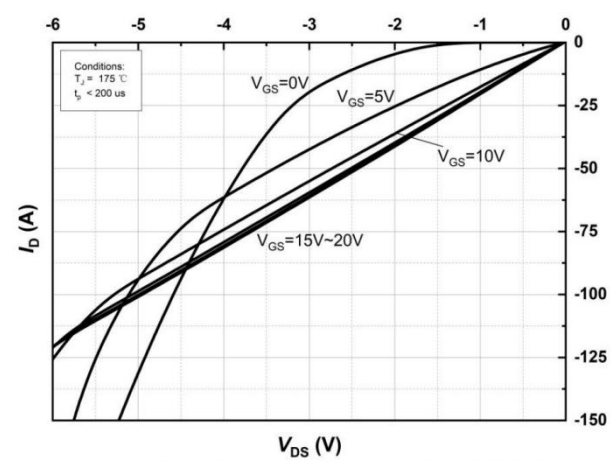


Figure 12. 3rd Quadrant Characteristic at  $T_j=175^{\circ}\text{C}$

### Typical Characteristics

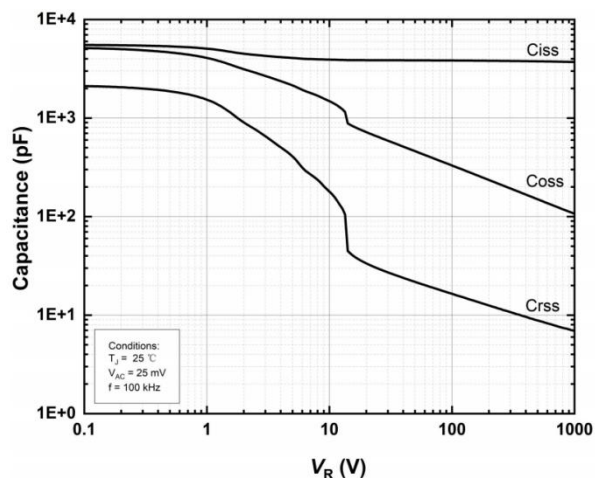


Figure 13. Capacitances vs. Drain-Source Voltage (0 – 1000V)

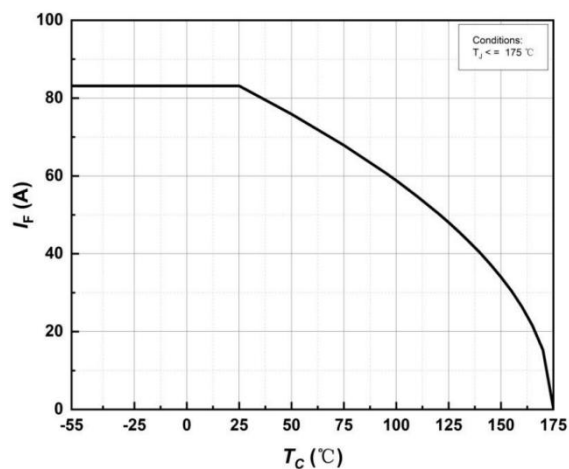


Figure 14. Continuous Drain Current Derating vs Case Temperature

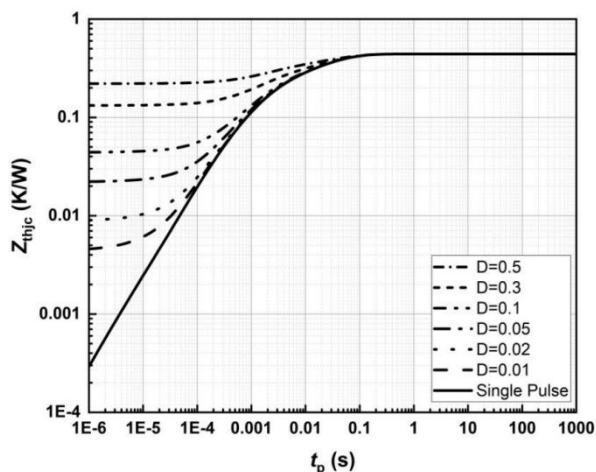


Figure 15. Transient Thermal Impedance (Junction – Case)

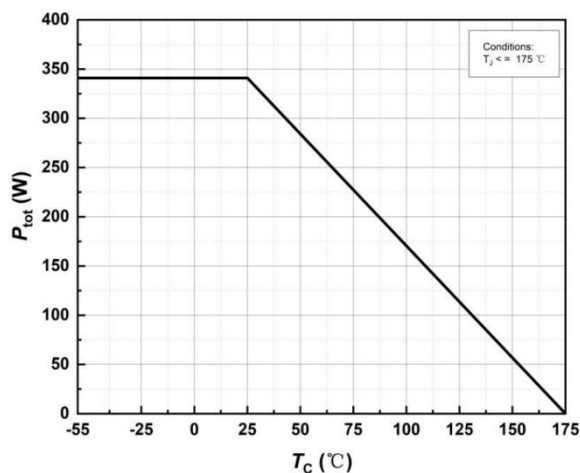


Figure 16. Maximum Power Dissipation Derating vs. Case Temperature

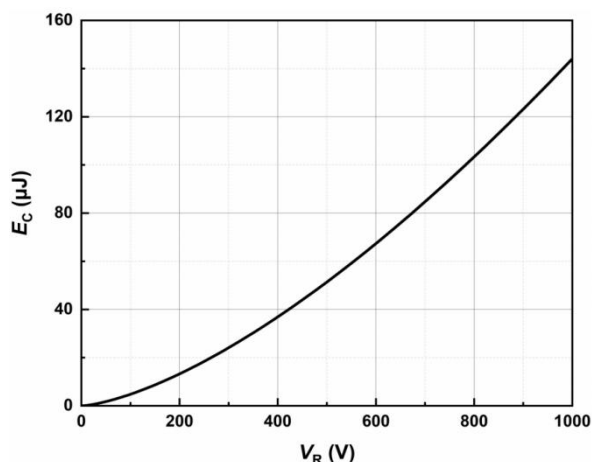


Figure 17. Output Capacitor Stored Energy

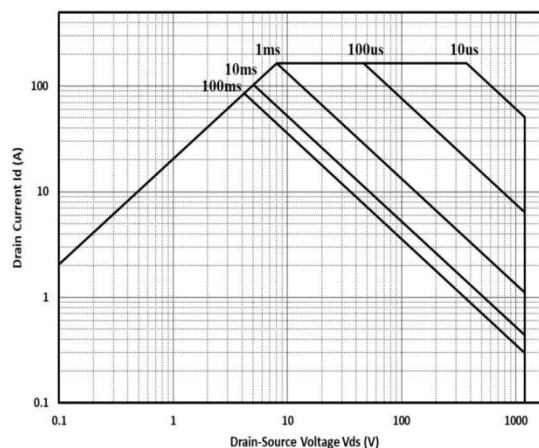


Figure 18. Safe Operating Area

## Typical Characteristics

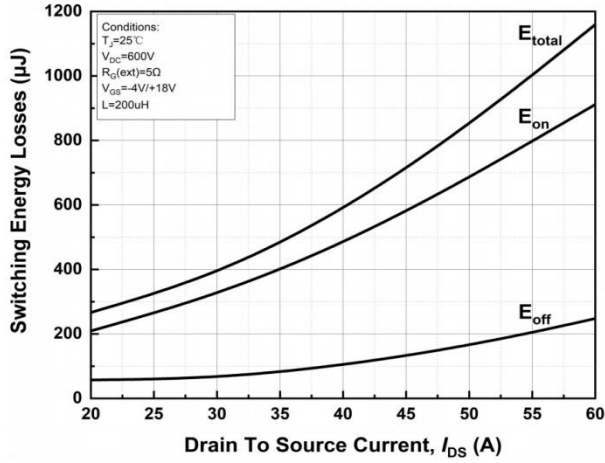


Figure 19. Clamped Inductive Switching Energy vs. Drain Current( $V_{DD} = 600\text{V}$ )

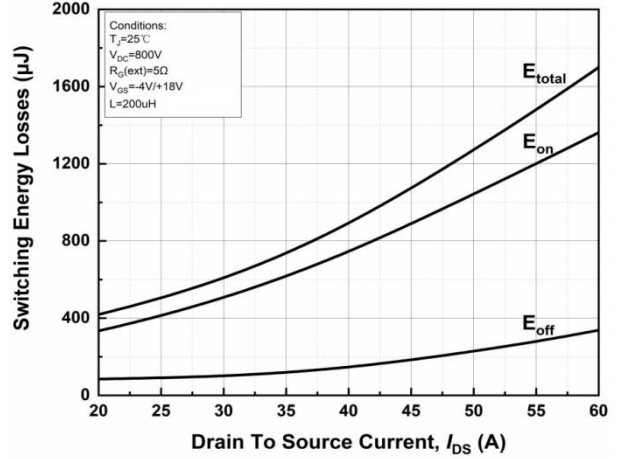


Figure 20. Clamped Inductive Switching Energy vs. Drain Current( $V_{DD} = 800\text{V}$ )

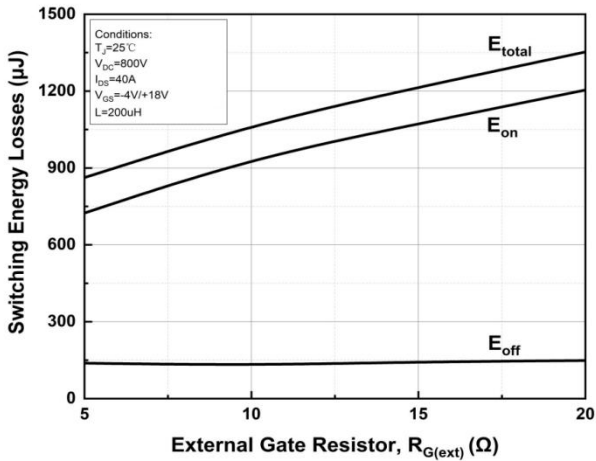


Figure 21. Clamped Inductive Switching Energy vs.  $R_{G(\text{ext})}$

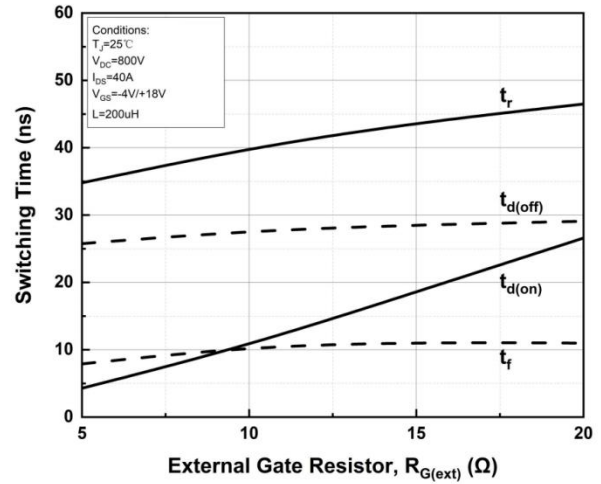
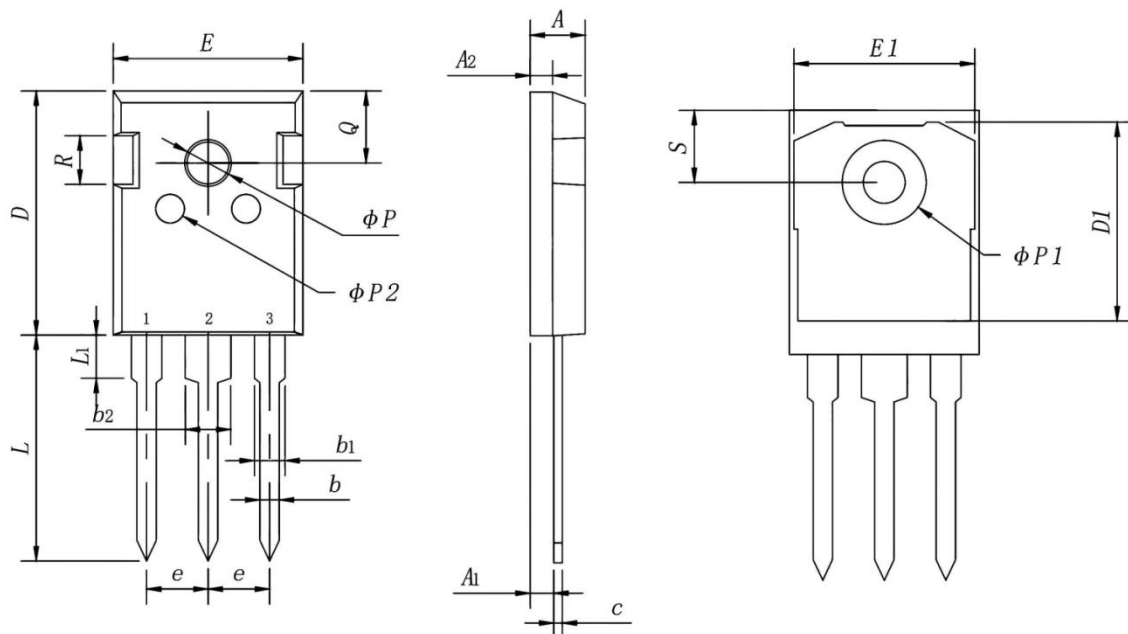


Figure 22. Switching Times vs.  $R_{G(\text{ext})}$

## TO-247-3L Package Information



| Symbol    | Dimensions In Millimeters |        | Dimensions In Inches |       |
|-----------|---------------------------|--------|----------------------|-------|
|           | Min.                      | Max.   | Min.                 | Max.  |
| A         | 4.700                     | 5.300  | 0.185                | 0.209 |
| A1        | 2.240                     | 2.580  | 0.088                | 0.102 |
| A2        | 1.800                     | 2.200  | 0.071                | 0.087 |
| b         | 1.000                     | 1.400  | 0.039                | 0.055 |
| b1        | 1.600                     | 2.600  | 0.063                | 0.102 |
| b2        | 2.600                     | 3.600  | 0.102                | 0.142 |
| c         | 0.400                     | 0.800  | 0.016                | 0.031 |
| D         | 20.000                    | 22.000 | 0.787                | 0.866 |
| D1        | 15.240                    | 17.240 | 0.600                | 0.679 |
| E         | 15.500                    | 16.010 | 0.610                | 0.630 |
| E1        | 13.770                    | 14.270 | 0.542                | 0.562 |
| e         | 5.200                     | 5.720  | 0.205                | 0.225 |
| L         | 19.700                    | 20.200 | 0.776                | 0.795 |
| L1        | 3.850                     | 4.450  | 0.152                | 0.175 |
| $\phi P$  | 3.550                     | 3.650  | 0.140                | 0.144 |
| $\phi P1$ | 7.140                     | 7.240  | 0.281                | 0.285 |
| $\phi P2$ | 2.350                     | 2.450  | 0.093                | 0.096 |
| Q         | 5.890                     | 6.400  | 0.232                | 0.252 |
| R         | 4.300                     | 4.900  | 0.169                | 0.193 |
| S         | 6.040                     | 6.300  | 0.238                | 0.248 |