

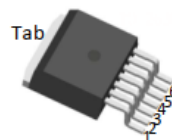


### 1700V SiC N-Channel MOSFET

#### DESCRIPTION :

- Qualified According to AEC-Q101
- High Speed Switching with Low Capacitances
- High Blocking Voltage with Low  $R_{DS(ON)}$
- Easy to Parallel
- Simple to Drive
- RoHS compliant.

|              |                                 |
|--------------|---------------------------------|
| $V_{DS}$     | 1700V                           |
| $I_D$        | 9A ( $T_c=25^{\circ}\text{C}$ ) |
| $R_{DS(ON)}$ | 565m $\Omega$                   |



TO-263-7L

#### TYPICAL APPLICATIONS :

- Power Factor Correction Modules
- Switch Mode Power Supplies
- DC-AC Inverters
- High Voltage DC-DC Converters

#### MAXIMUM RATINGS (at $T_J = 25^{\circ}\text{C}$ , unless otherwise specified)

| Characteristic                 | Condition                                             | Symbol      | Value    | Unit               |
|--------------------------------|-------------------------------------------------------|-------------|----------|--------------------|
| Drain-Source Voltage           |                                                       | $V_{DS}$    | 1700     | V                  |
| Continuous Drain Current       | $T_c=25^{\circ}\text{C}$<br>$T_c=100^{\circ}\text{C}$ | $I_D$       | 9<br>6   | A                  |
| Peak Drain Current             | Pulse width $t_p$ limited by $T_{Jmax}$               | $I_{DM}$    | 15       | A                  |
| Gate-Source Voltage            |                                                       | $V_{GSmax}$ | -8/+22   | V                  |
| Recommend Gate-Source Voltage  |                                                       | $V_{GSop}$  | -4/+18   | V                  |
| Power Dissipation              | $T_c=25^{\circ}\text{C}$<br>$T_c=100^{\circ}\text{C}$ | $P_{TOT}$   | 94<br>47 | W                  |
| Operation Junction temperature |                                                       | $T_J$       | -40~+175 | $^{\circ}\text{C}$ |
| Storage temperature            |                                                       | $T_{STG}$   | -40~+175 | $^{\circ}\text{C}$ |



### ELECTRICAL CHARACTERISTICS (at $T_J = 25^\circ\text{C}$ , unless otherwise specified)

| Characteristic                                                                                                                                                                | Symbol        | Min. | Typ.        | Max. | Unit          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------|-------------|------|---------------|
| Drain-Source Breakdown Voltage<br>$V_{GS} = 0\text{V}$ , $I_D = 100\mu\text{A}$                                                                                               | $V_{(BR)DSS}$ | 1700 |             |      | V             |
| Zero Gate Voltage Drain Current<br>$V_{DS} = 1700\text{V}$ , $V_{GS} = 0\text{V}$                                                                                             | $I_{DSS}$     |      | 1           | 10   | $\mu\text{A}$ |
| Gate-Source Leakage Current<br>$V_{GS} = 18\text{V}$ , $V_{DS} = 0\text{V}$                                                                                                   | $I_{GSS}$     |      |             | 250  | nA            |
| Gate-Source Threshold Voltage<br>$V_{DS} = V_{GS}$ , $I_D = 0.5\text{mA}$ $T_J = 25^\circ\text{C}$<br>$V_{DS} = V_{GS}$ , $I_D = 0.5\text{mA}$ $T_J = 175^\circ\text{C}$      | $V_{GS(th)}$  | 2.0  | 2.9<br>2.0  | 4.0  | V             |
| Drain-Source On-State Resistance<br>$V_{GS} = 18\text{V}$ , $I_D = 2\text{A}$ $T_J = 25^\circ\text{C}$<br>$V_{GS} = 18\text{V}$ , $I_D = 2\text{A}$ $T_J = 175^\circ\text{C}$ | $R_{DS(on)}$  |      | 565<br>1010 | 700* | m $\Omega$    |
| Input capacitance<br>$f = 1\text{MHz}$ , $V_{DS} = 1000\text{V}$ , $V_{GS} = 0\text{V}$                                                                                       | $C_{iss}$     |      | 268         |      | pF            |
| Output capacitance<br>$f = 1\text{MHz}$ , $V_{DS} = 1000\text{V}$ , $V_{GS} = 0\text{V}$                                                                                      | $C_{oss}$     |      | 20.2        |      | pF            |
| Reverse transfer capacitance<br>$f = 1\text{MHz}$ , $V_{DS} = 1000\text{V}$ , $V_{GS} = 0\text{V}$                                                                            | $C_{rss}$     |      | 3.1         |      | pF            |
| Internal Gate Resistance<br>$f = 1\text{MHz}$                                                                                                                                 | $R_{G(INT)}$  |      | 10.7        |      | $\Omega$      |
| Total Gate Charge<br>$V_{DS} = 1200\text{V}$ , $I_D = 2\text{A}$ , $V_{GS} = -4/18\text{V}$                                                                                   | $Q_G$         |      | 20          |      | nC            |
| Gate to Source Charge<br>$V_{DS} = 1200\text{V}$ , $I_D = 2\text{A}$ , $V_{GS} = -4/18\text{V}$                                                                               | $Q_{GS}$      |      | 4           |      | nC            |
| Gate to Drain Charge<br>$V_{DS} = 1200\text{V}$ , $I_D = 2\text{A}$ , $V_{GS} = -4/18\text{V}$                                                                                | $Q_{GD}$      |      | 10          |      | nC            |
| Turn-on Delay Time<br>$V_{DD} = 1200\text{V}$ , $I_D = 2\text{A}$ , $V_{GS} = -4/18\text{V}$ , $R_G = 2.5\Omega$ , $L = 600\mu\text{H}$                                       | $t_{d(ON)}$   |      | 8           |      | ns            |
| Rise Time<br>$V_{DD} = 1200\text{V}$ , $I_D = 2\text{A}$ , $V_{GS} = -4/18\text{V}$ , $R_G = 2.5\Omega$ , $L = 600\mu\text{H}$                                                | $t_r$         |      | 12          |      | ns            |
| Turn-off Delay Time<br>$V_{DD} = 1200\text{V}$ , $I_D = 2\text{A}$ , $V_{GS} = -4/18\text{V}$ , $R_G = 2.5\Omega$ , $L = 600\mu\text{H}$                                      | $t_{d(OFF)}$  |      | 11          |      | ns            |
| Fall Time<br>$V_{DD} = 1200\text{V}$ , $I_D = 2\text{A}$ , $V_{GS} = -4/18\text{V}$ , $R_G = 2.5\Omega$ , $L = 600\mu\text{H}$                                                | $t_f$         |      | 96          |      | ns            |
| Turn-on Switching Energy<br>$V_{DD} = 1200\text{V}$ , $I_D = 2\text{A}$ , $V_{GS} = -4/18\text{V}$ , $R_G = 2.5\Omega$ , $L = 600\mu\text{H}$                                 | $E_{(ON)}$    |      | 118         |      | $\mu\text{J}$ |
| Turn-off Switching Energy<br>$V_{DD} = 1200\text{V}$ , $I_D = 2\text{A}$ , $V_{GS} = -4/18\text{V}$ , $R_G = 2.5\Omega$ , $L = 600\mu\text{H}$                                | $E_{(OFF)}$   |      | 19          |      | $\mu\text{J}$ |

\*Notes: This is "Preliminary" data.



### THERMAL CHARACTERISTICS

| Characteristic                      | Condition | Symbol        | Typical | Unit |
|-------------------------------------|-----------|---------------|---------|------|
| Thermal resistance, junction - case |           | $R_{th(j-c)}$ | 1.59    | °C/W |

### Body Diode

#### ELECTRICAL CHARACTERISTICS (at $T_j = 25^\circ\text{C}$ , unless otherwise specified)

| Characteristic                                                                                                                                                                                                  | Symbol    | Min. | Typ.                     | Max. | Unit |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------|--------------------------|------|------|
| Diode Forward Voltage<br>VGS = -4V, ISD = 1A $T_j=25^\circ\text{C}$<br>VGS = -4V, ISD = 1A $T_j=175^\circ\text{C}$<br>VGS = -4V, ISD = 2A $T_j=25^\circ\text{C}$<br>VGS = -4V, ISD = 2A $T_j=175^\circ\text{C}$ | $V_{SD}$  |      | 4.0<br>3.5<br>4.6<br>3.9 |      | V    |
| Continuous Diode Forward Current<br>VGS = -4V, $T_c=25^\circ\text{C}$<br>VGS = -4V, $T_c=100^\circ\text{C}$                                                                                                     | $I_S$     |      | 9<br>6                   |      | A    |
| Revers Recovery Time<br>VR=1200 V, ISD=2A, VGS= -4V, di/dt = 1338A/us                                                                                                                                           | $T_{rr}$  |      | 52                       |      | ns   |
| Revers Recovery Charge<br>VR=1200 V, ISD=2A, VGS= -4V, di/dt = 1338A/us                                                                                                                                         | $Q_{rr}$  |      | 96                       |      | nC   |
| Peak Revers Recovery Current<br>VR=1200 V, ISD=2A, VGS= -4V, di/dt = 1338A/us                                                                                                                                   | $I_{rrm}$ |      | 4                        |      | A    |

### Typical Characteristics

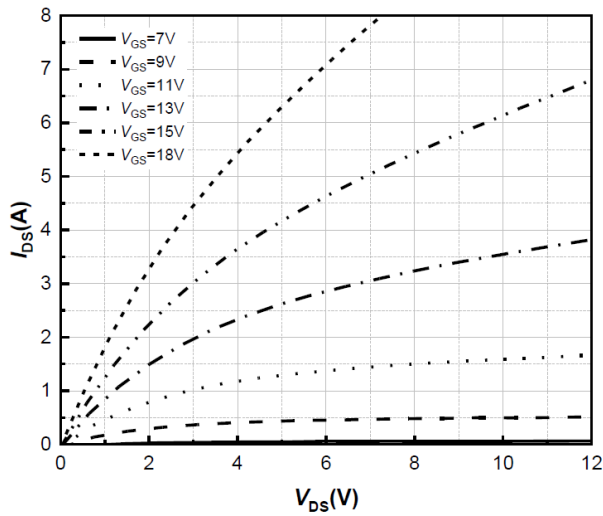


Figure 1. Output Characteristics ( $T_j = -40^\circ\text{C}$ )

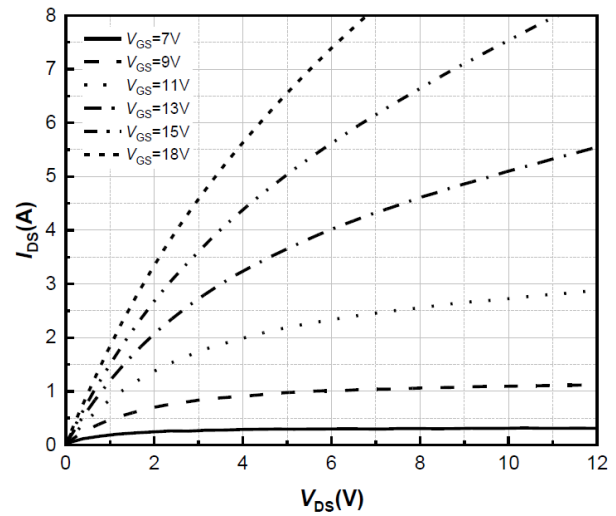


Figure 2. Output Characteristics ( $T_j = 25^\circ\text{C}$ )

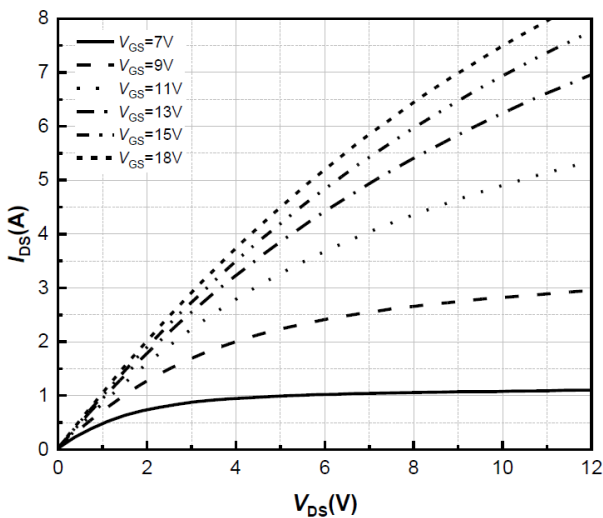


Figure 3. Output Characteristics ( $T_j = 175^\circ\text{C}$ )

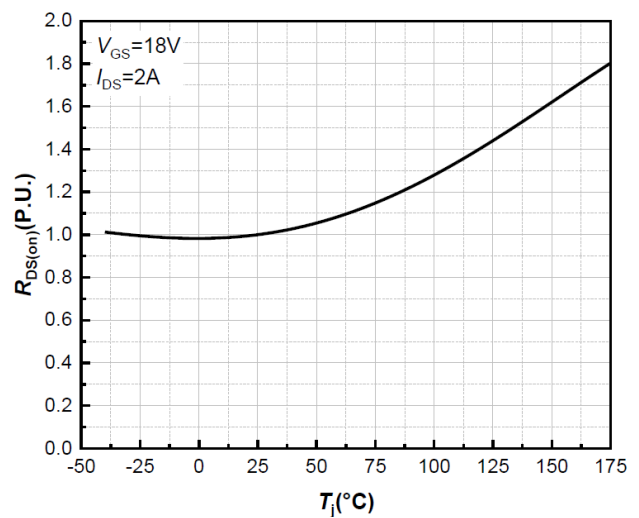


Figure 4. Normalized On-Resistance vs. Temperature

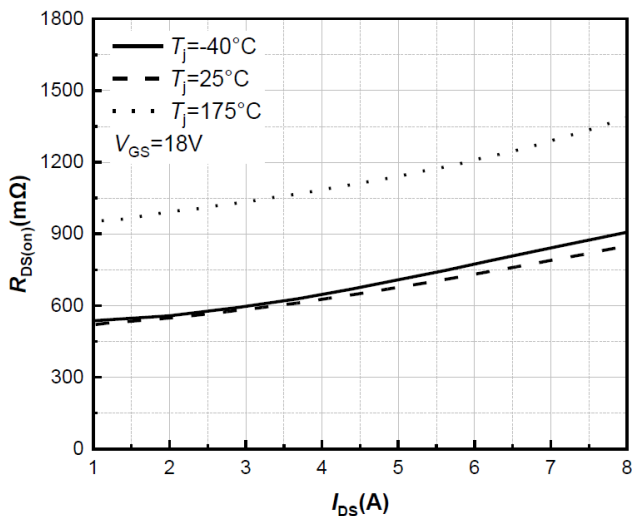


Figure 5. On-Resistance vs. Drain Current For Various Temperatures

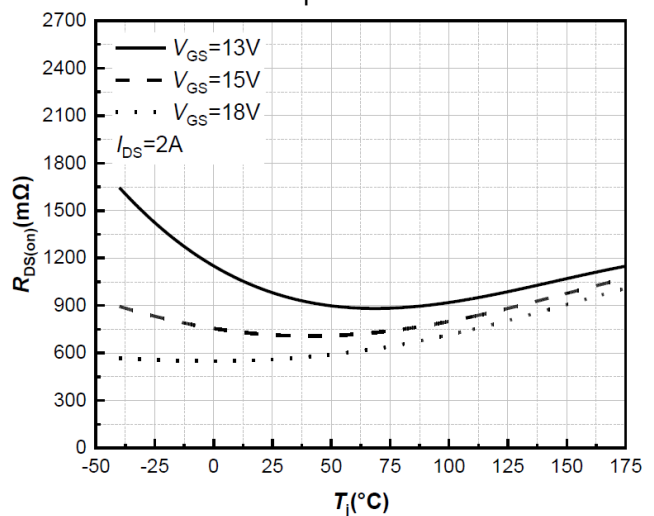


Figure 6. On-Resistance vs. Temperature For Various Gate Voltage

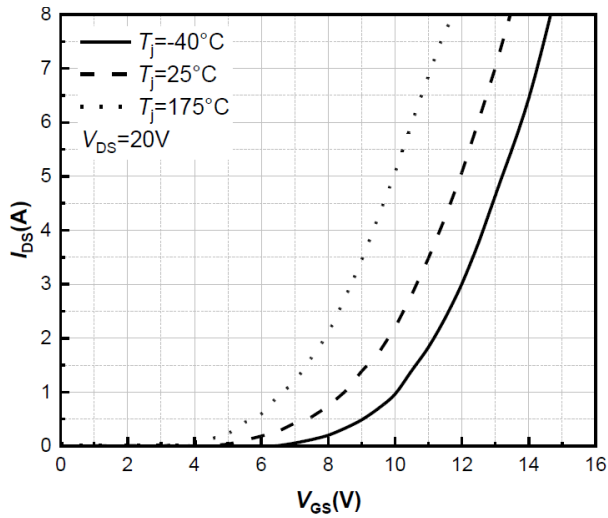


Figure 7. Transfer Characteristic for Various Junction Temperatures

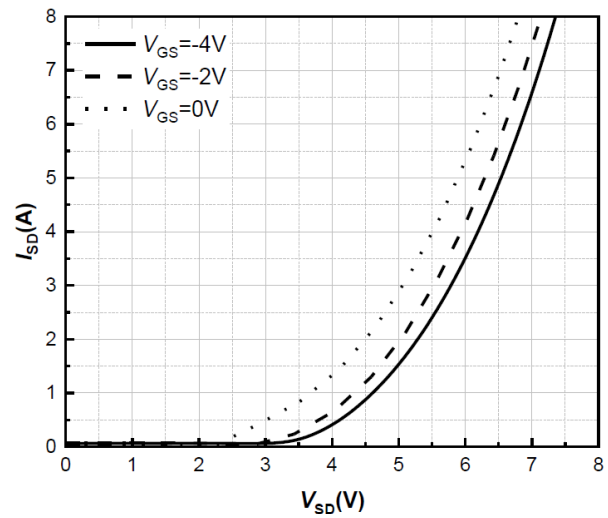


Figure 8. Body Diode Characteristic  $T_J = -40^{\circ}\text{C}$

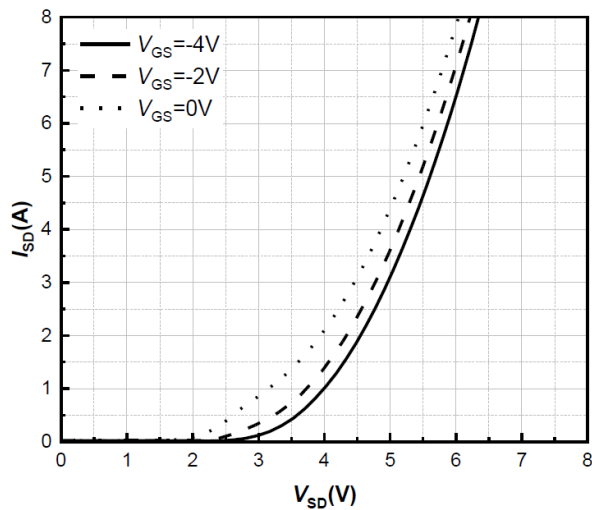


Figure 9. Body Diode Characteristic ( $T_J = 25^{\circ}\text{C}$ )

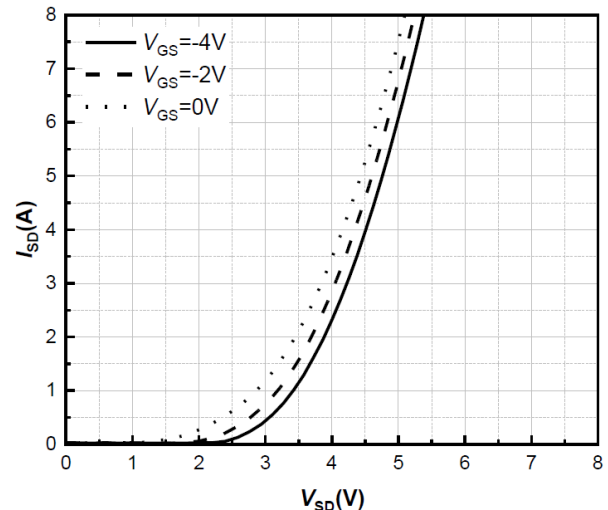


Figure 10. Body Diode Characteristic ( $T_J = 175^{\circ}\text{C}$ )

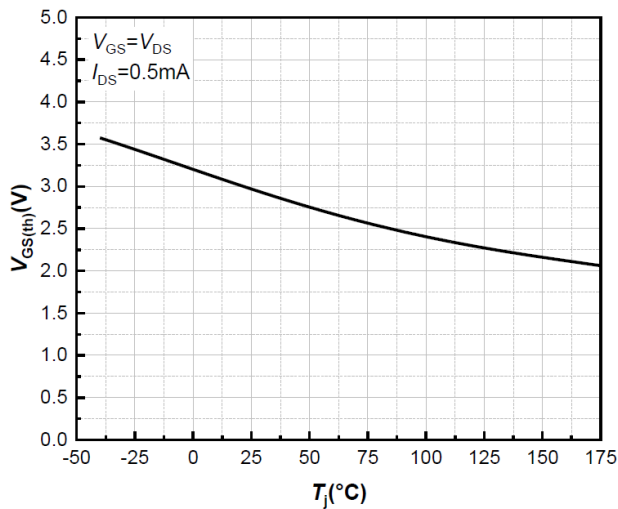


Figure 11. Threshold Voltage vs. Temperature

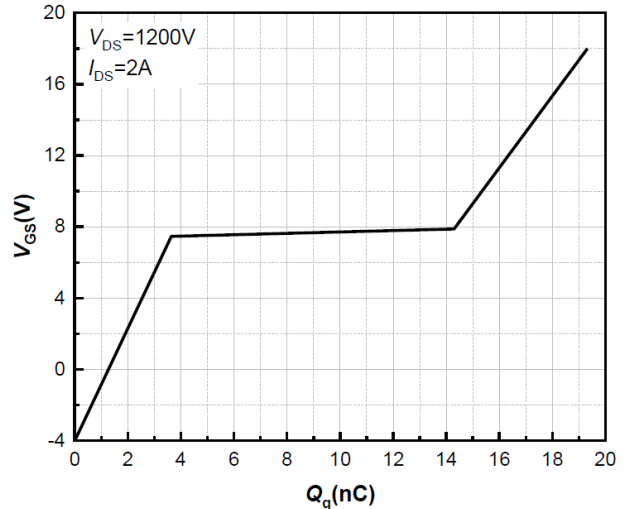


Figure 12. Gate Charge Characteristics

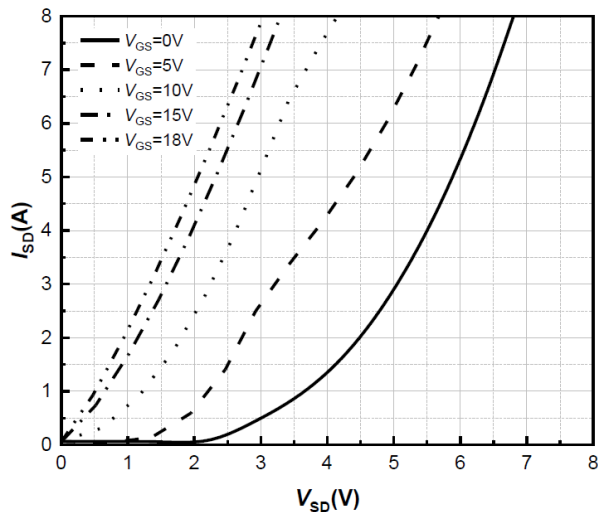


Figure 13. 3rd Quadrant Characteristic (Tj=-40°C)

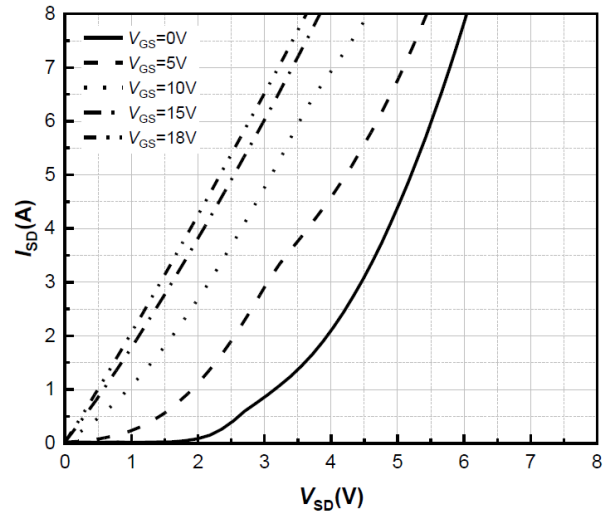


Figure 14. 3rd Quadrant Characteristic (Tj=25°C)

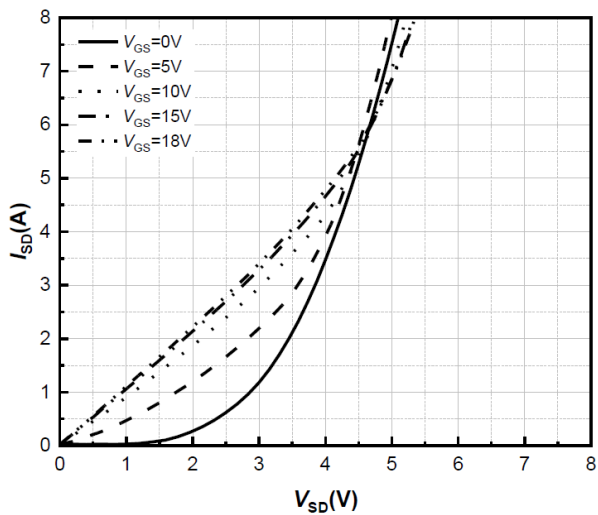


Figure 15. 3rd Quadrant Characteristic (Tj=175°C)

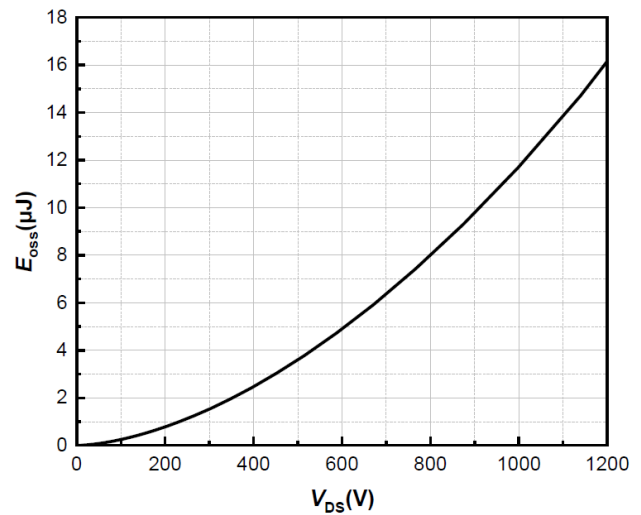


Figure 16. Output Capacitor Stored Energy

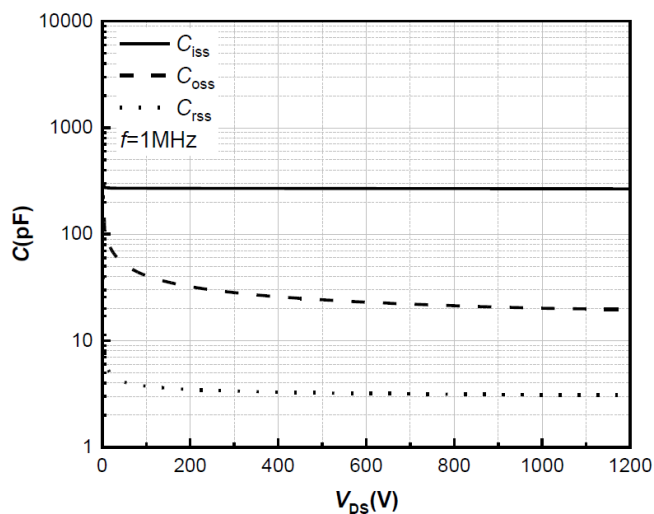


Figure 17. Capacitances vs. Drain-Source

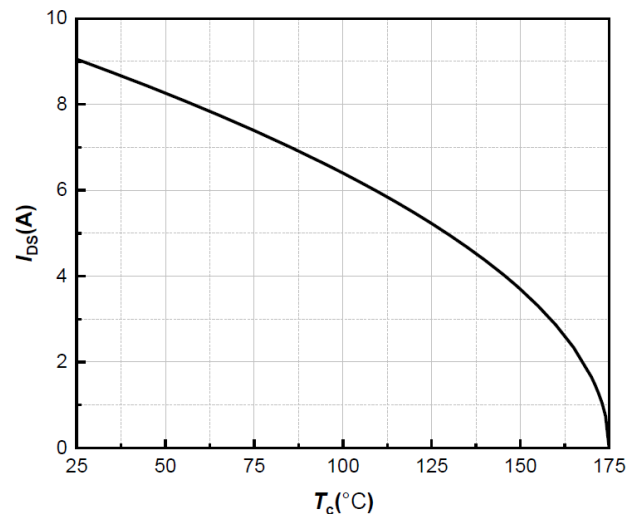


Figure 18. Continuous Drain Current Derating vs. Case Temperature

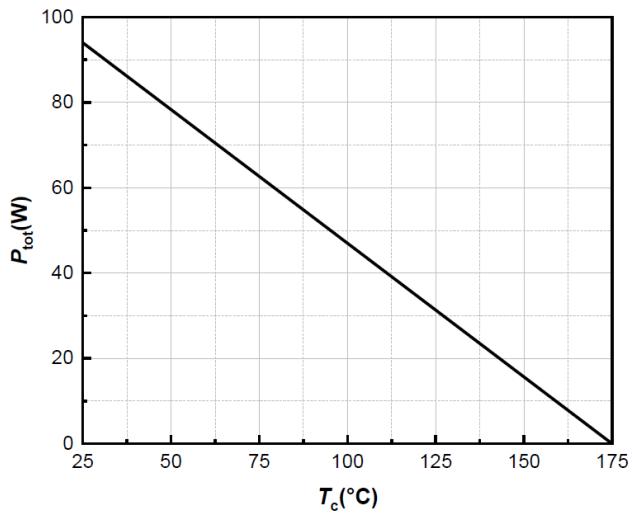


Figure 19. Maximum Power Dissipation Derating vs. Case Temperature

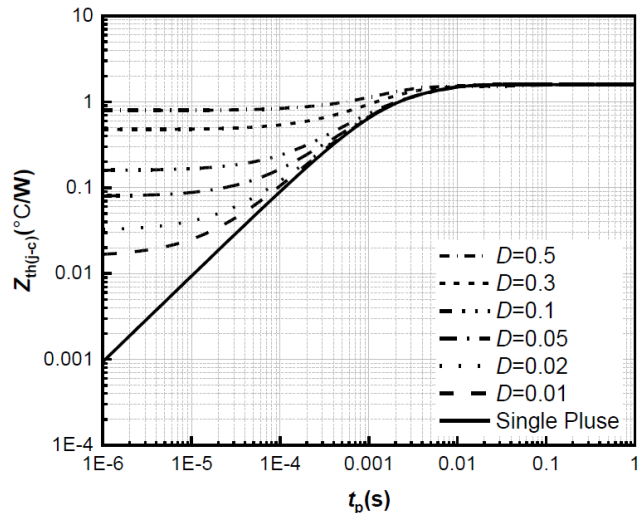


Figure 20. Transient Thermal Impedance

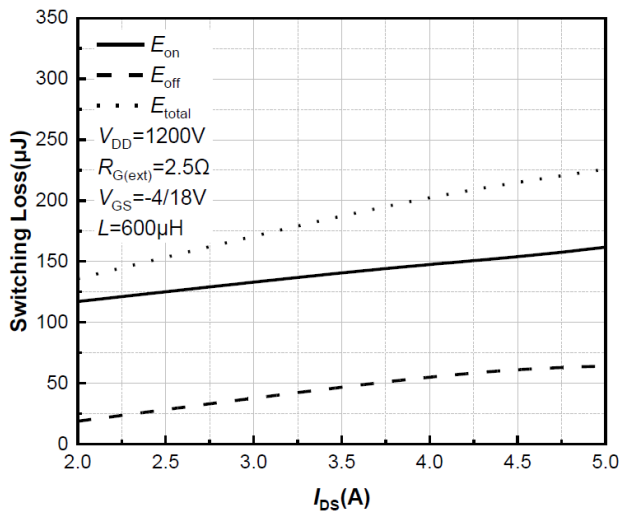


Figure 21. Clamped Inductive Switching Energy vs. Drain Current

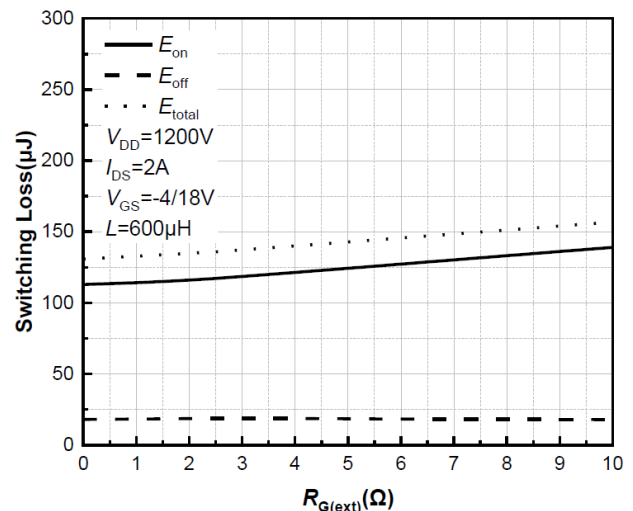


Figure 22. Clamped Inductive Switching Energy vs.  $R_G$

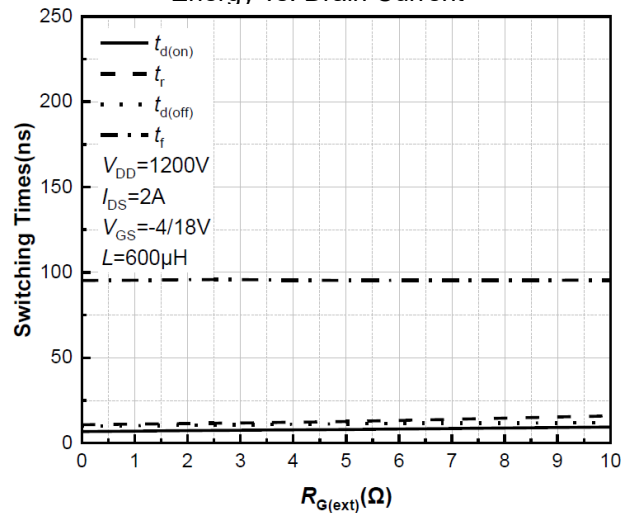


Figure 23. Switching Times vs.  $R_G$

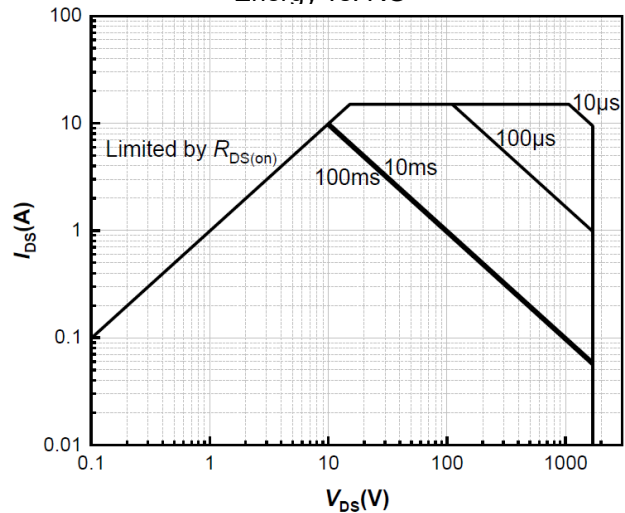
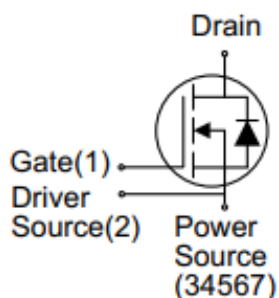
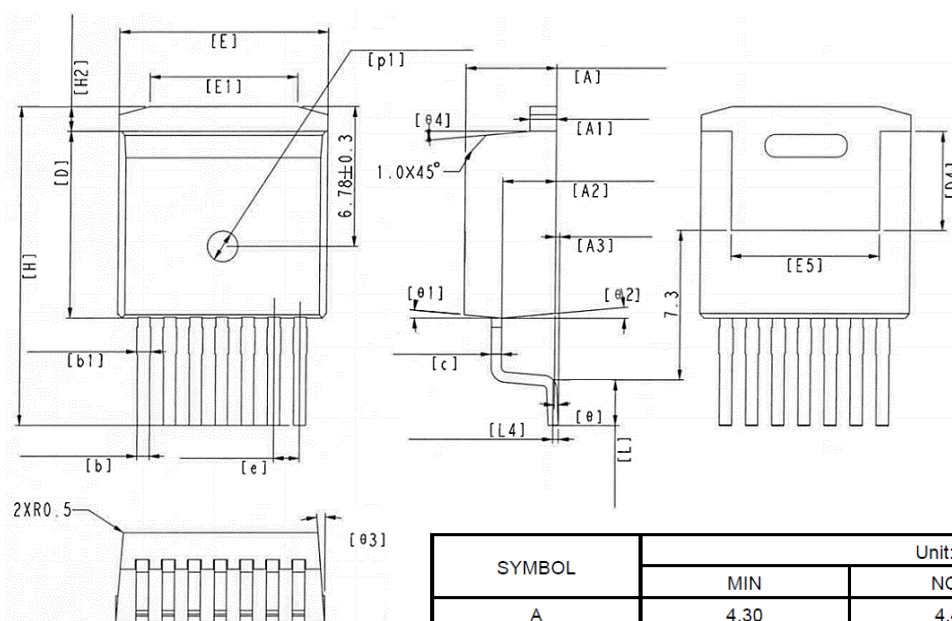


Figure 24. Safe Operating Area

### ·Circuit diagram



### ·TO-263-7L Package outlines : Dimensions in (mm)



| SYMBOL | Unit: mm |       |       |
|--------|----------|-------|-------|
|        | MIN      | NOM   | MAX   |
| A      | 4.30     | 4.43  | 4.56  |
| A1     | 1.2      | 1.3   | 1.4   |
| A2     | 2.45     | 2.60  | 2.75  |
| A3     | 0.00     | 0.13  | 0.25  |
| b      | 0.5      | 0.6   | 0.7   |
| b1     | 0.6      | 0.7   | 0.9   |
| c      | 0.45     | 0.50  | 0.60  |
| D      | 8.93     | 9.08  | 9.23  |
| D4     | 4.65     | 4.80  | 4.95  |
| E      | 10.08    | 10.18 | 10.28 |
| E1     | 6.5      | 7.0   | 7.5   |
| E5     | 6.82     | 7.22  | 7.62  |
| e      | 1.27BSC  |       |       |
| H      | 15.0     | 15.5  | 16.0  |
| H2     | 0.98     | 1.20  | 1.42  |
| L      | 1.9      | 2.2   | 2.5   |
| L4     | 0.25BSC  |       |       |
| p1     | 1.4      | 1.5   | 1.6   |
| θ      | 0°       | 3°    | 7°    |
| θ1     | 3°       | 5°    | 7°    |
| θ2     | 3°       | 5°    | 7°    |
| θ3     | 3°       | 5°    | 7°    |
| θ4     | 3°       | 5°    | 7°    |