

## N-Channel 750V (D-S) SiC MOSFET

### Features

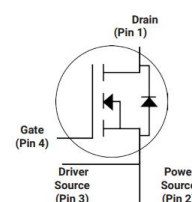
- Wide bandgap SiC MOSFET technology
- Low On-Resistance with High Blocking Voltage
- Low Capacitances with High-Speed switching
- Low reverse recovery(Qrr)
- Halogen free, RoHs compliant



TO-247-4L

### Applications

- Switch mode power supplies
- Renewable energy
- On Board Charger
- High voltage DC/DC converters



### Absolute Maximum Ratings ( $T_J=25^{\circ}\text{C}$ unless otherwise noted)

| Parameter                                           |                       | Symbol                           | Ratings     | Unit |
|-----------------------------------------------------|-----------------------|----------------------------------|-------------|------|
| Drain Source Voltage                                |                       | V <sub>DS</sub>                  | 750         | V    |
| Gate Source Voltage                                 |                       | V <sub>GS</sub>                  | -8/+22      | V    |
| Recommend Gate Source Voltage                       |                       | V <sub>GSop</sub>                | -4/+18      | V    |
| Drain Current Continuous<br>V <sub>GS</sub> =18V    | T <sub>C</sub> =25°C  | I <sub>D</sub>                   | 153         | A    |
|                                                     | T <sub>C</sub> =125°C |                                  | 89          |      |
| Power Dissipation                                   | T <sub>C</sub> =25°C  | P <sub>D</sub>                   | 429         | W    |
| Operating Temperature and Storage Temperature Range |                       | T <sub>J</sub> /T <sub>STG</sub> | -55 to +175 | °C   |

### Thermal Characteristics

| Parameter                              | Symbol     | Max. | Unit                 |
|----------------------------------------|------------|------|----------------------|
| Thermal Resistance Junction to Case    | $R_{thJC}$ | 0.35 | $^{\circ}\text{C/W}$ |
| Thermal Resistance Junction to Ambient | $R_{thJA}$ | 40   | $^{\circ}\text{C/W}$ |

| Electrical Characteristics (T <sub>J</sub> =25°C unless otherwise noted) |                      |                                                                                                       |      |      |      |      |
|--------------------------------------------------------------------------|----------------------|-------------------------------------------------------------------------------------------------------|------|------|------|------|
| Parameter                                                                | Symbol               | Test Conditions                                                                                       | Min. | Typ. | Max. | Unit |
| Drain Source Breakdown Voltage                                           | V <sub>(BR)DSS</sub> | V <sub>GS</sub> =0V, I <sub>D</sub> =100μA                                                            | 750  | --   | --   | V    |
| Gate Leakage Current                                                     | I <sub>GSS</sub>     | V <sub>GS</sub> =18V, V <sub>DS</sub> =0V                                                             | --   | --   | 100  | nA   |
| Zero Gate Voltage Drain Current                                          | I <sub>DSS</sub>     | V <sub>DS</sub> =750V, V <sub>GS</sub> =0V                                                            | --   | 1    | 5    | μA   |
| Gate Threshold Voltage                                                   | V <sub>GS(TH)</sub>  | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>DS</sub> =36mA                                              | 2    | 3    | 4    | V    |
|                                                                          |                      | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>DS</sub> =36mA, T <sub>J</sub> =175°C                       | --   | 1.9  | --   |      |
| Drain-Source On-state Resistance                                         | R <sub>DS(on)</sub>  | V <sub>GS</sub> =18V, I <sub>D</sub> =80A                                                             | --   | 11   | 13   | mΩ   |
|                                                                          |                      | V <sub>GS</sub> =18V, I <sub>D</sub> =80A, T <sub>J</sub> =175°C                                      | --   | 16   | --   |      |
| Drain-Source On-state Resistance                                         | R <sub>DS(on)</sub>  | V <sub>GS</sub> =15V, I <sub>D</sub> =80A                                                             | --   | 14   | 18   | mΩ   |
|                                                                          |                      | V <sub>GS</sub> =15V, I <sub>D</sub> =80A, T <sub>J</sub> =175°C                                      | --   | 18   | --   |      |
| Total Gate Charge                                                        | Q <sub>g</sub>       | V <sub>GS(off)</sub> =-4V, V <sub>GS(on)</sub> =18V<br>V <sub>DD</sub> =600V, I <sub>D</sub> =80A     | --   | 157  | --   | nC   |
| Gate Source Charge                                                       | Q <sub>gs</sub>      |                                                                                                       | --   | 21.6 | --   |      |
| Gate Drain Charge                                                        | Q <sub>gd</sub>      |                                                                                                       | --   | 25.6 | --   |      |
| Turn-On Switching Energy                                                 | E <sub>ON</sub>      | V <sub>GS</sub> =-4/+18V, V <sub>DD</sub> =600V ·<br>I <sub>D</sub> =80A, R <sub>G</sub> =5Ω, L=100uH | --   | 545  | --   | μJ   |
| Turn-Off Switching Energy                                                | E <sub>OFF</sub>     |                                                                                                       | --   | 540  | --   |      |
| Turn-on Delay Time                                                       | t <sub>d(on)</sub>   |                                                                                                       | --   | 21   | --   | ns   |
| Turn-on Rise Time                                                        | t <sub>r</sub>       |                                                                                                       | --   | 15.6 | --   |      |
| Turn-off Delay Time                                                      | t <sub>d(off)</sub>  |                                                                                                       | --   | 60.2 | --   |      |
| Turn-off Fall Time                                                       | t <sub>f</sub>       |                                                                                                       | --   | 22   | --   |      |
| Input Capacitance                                                        | C <sub>iss</sub>     | V <sub>GS</sub> =0V, V <sub>DS</sub> =600V,<br>V <sub>AC</sub> =25mV, f=1MHz                          | --   | 4877 | --   | pF   |
| Output Capacitance                                                       | C <sub>oss</sub>     |                                                                                                       | --   | 303  | --   |      |
| Reverse Transfer Capacitance                                             | C <sub>rss</sub>     |                                                                                                       | --   | 19.6 | --   |      |
| Gate resistance                                                          | R <sub>G</sub>       | V <sub>AC</sub> = 25mV, f=1MHz                                                                        | --   | 2.2  | --   | Ω    |

## Reverse Diode Characteristics (T<sub>J</sub>=25°C unless otherwise noted)

| Parameter                        | Symbol           | Test Conditions                                                                                             | Min. | Typ. | Max. | Unit |
|----------------------------------|------------------|-------------------------------------------------------------------------------------------------------------|------|------|------|------|
| Diode Forward Voltage            | V <sub>SD</sub>  | I <sub>SD</sub> =40A, V <sub>GS</sub> =-4V                                                                  | --   | 4.2  | --   | V    |
|                                  |                  | I <sub>SD</sub> =40A, V <sub>GS</sub> =-4V, T <sub>J</sub> =175°C                                           | --   | 3.8  | --   |      |
| Continuous Diode Forward Current | I <sub>SD</sub>  | V <sub>GS</sub> =-4V                                                                                        | --   | 153  | --   | A    |
| Reverse Recovery Time            | t <sub>rr</sub>  | V <sub>R</sub> =600V, I <sub>F</sub> =80A,<br>V <sub>GS</sub> =-4V, di/dt=1000A/μs                          | --   | 28.6 | --   | ns   |
| Reverse Recovery Charge          | Q <sub>rr</sub>  |                                                                                                             | --   | 260  | --   | nC   |
| Reverse Recovery Energy          | E <sub>REC</sub> |                                                                                                             | --   | 20   | --   | μJ   |
| Peak Reverse Recovery Current    | I <sub>rrm</sub> |                                                                                                             | --   | 16   | --   | A    |
| Charge Time                      | t <sub>A</sub>   |                                                                                                             | --   | 18.4 | --   | ns   |
| DisCharge Time                   | t <sub>B</sub>   |                                                                                                             | --   | 10.6 | --   | ns   |
| Reverse Recovery Time            | t <sub>rr</sub>  | V <sub>R</sub> =600V, I <sub>F</sub> =80A,<br>V <sub>GS</sub> =-4V, di/dt=1000A/μs<br>T <sub>J</sub> =175°C | --   | 38   | --   | ns   |
| Reverse Recovery Charge          | Q <sub>rr</sub>  |                                                                                                             | --   | 450  | --   | nC   |
| Reverse Recovery Energy          | E <sub>REC</sub> |                                                                                                             | --   | 40   | --   | μJ   |
| Peak Reverse Recovery Current    | I <sub>rrm</sub> |                                                                                                             | --   | 21   | --   | A    |
| Charge Time                      | t <sub>A</sub>   |                                                                                                             | --   | 22   | --   | ns   |
| DisCharge Time                   | t <sub>B</sub>   |                                                                                                             | --   | 16.4 | --   | ns   |

## Typical Characteristics Curves ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

Figure 1. Output Characteristic ( $T_J = -55^\circ\text{C}$ )

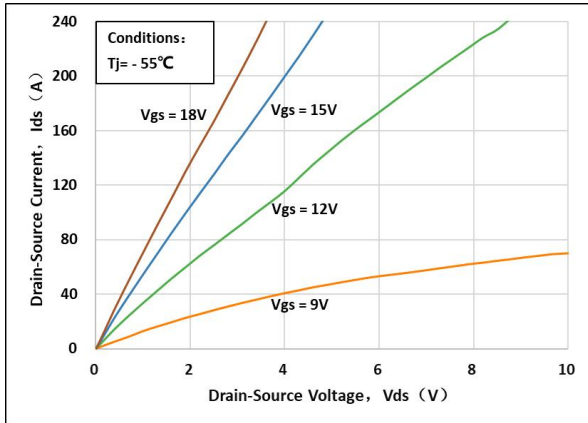


Figure 2. Output Characteristic ( $T_J = 25^\circ\text{C}$ )

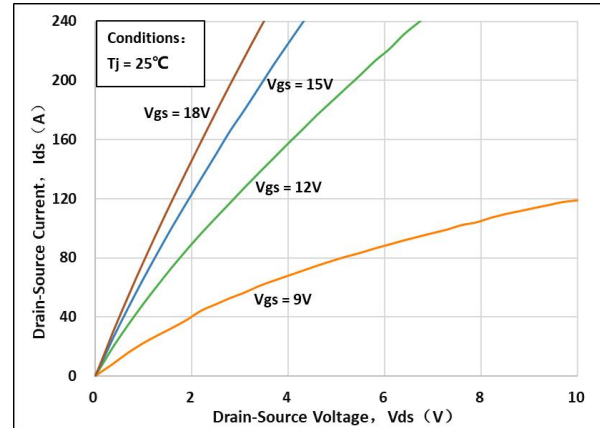


Figure 3. Output Characteristic ( $T_J = 175^\circ\text{C}$ )

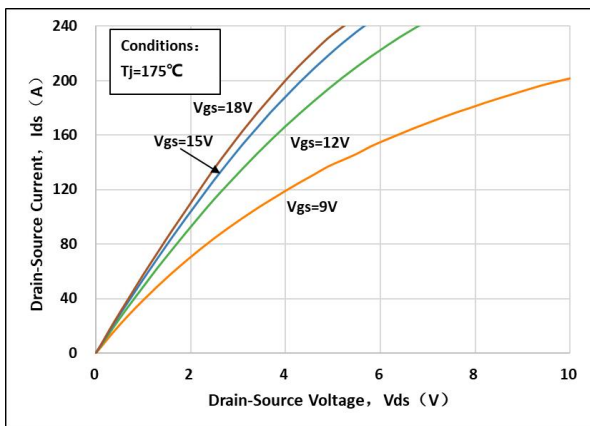


Figure 4.  $R_{DS(on)}$  Vs  $I_{DS}$  Characteristic

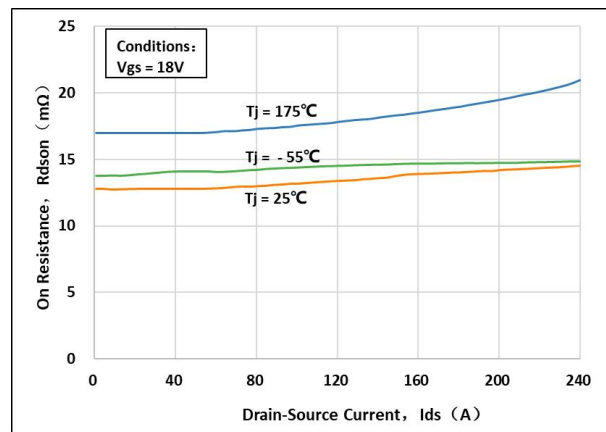


Figure 5.  $R_{DS(on)}$  vs. Temperature

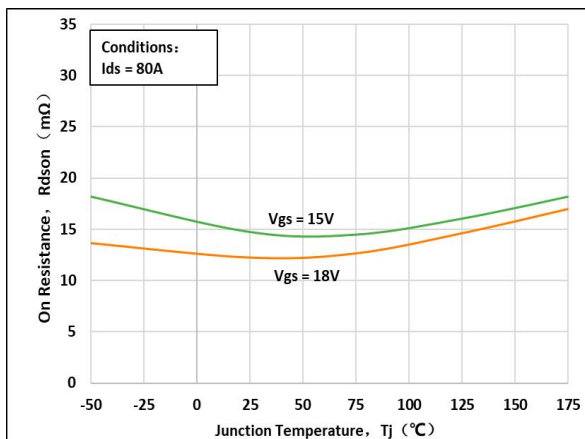
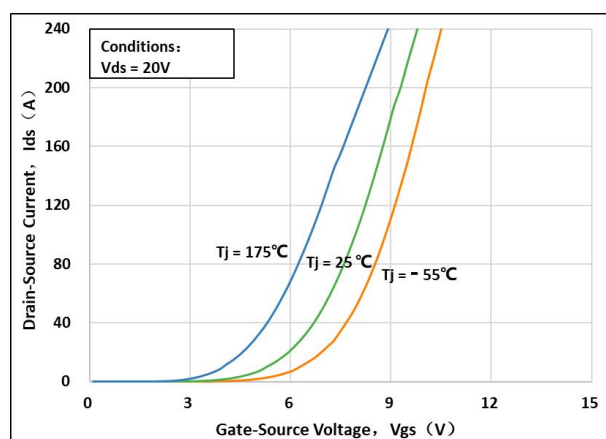


Figure 6. Transfer Characteristic



## Typical Characteristics Curves ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

Figure 7: Body-diode Characteristic ( $T_J = -55^\circ\text{C}$ )

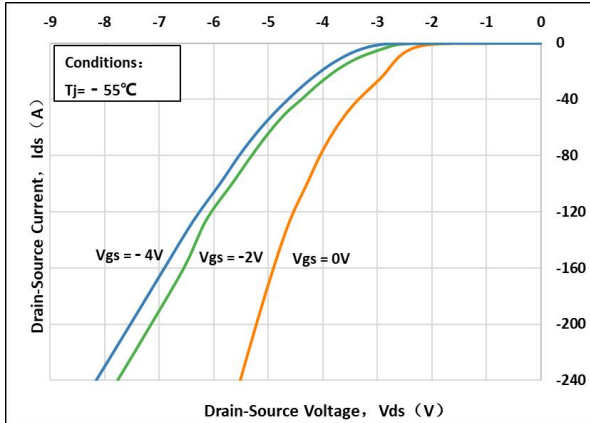


Figure 8: Body-diode Characteristic ( $T_J = 25^\circ\text{C}$ )

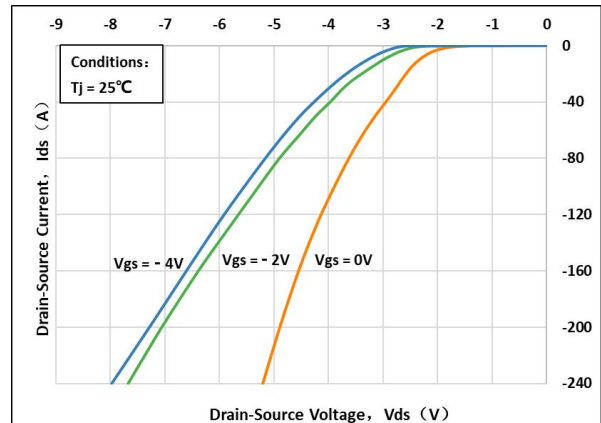


Figure 9: Body-diode Characteristic ( $T_J = 175^\circ\text{C}$ )

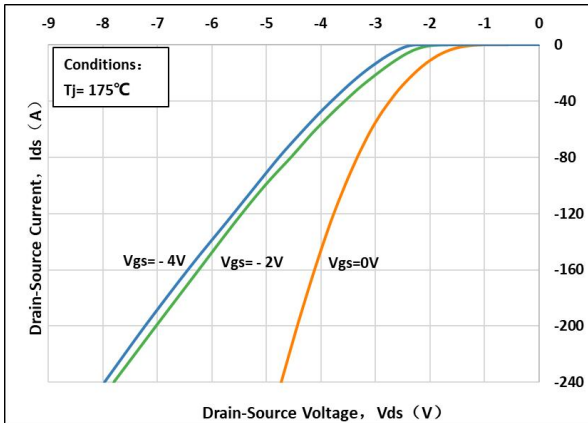


Figure 10:  $V_{TH}$  Vs  $T_J$  Temperature Characteristic

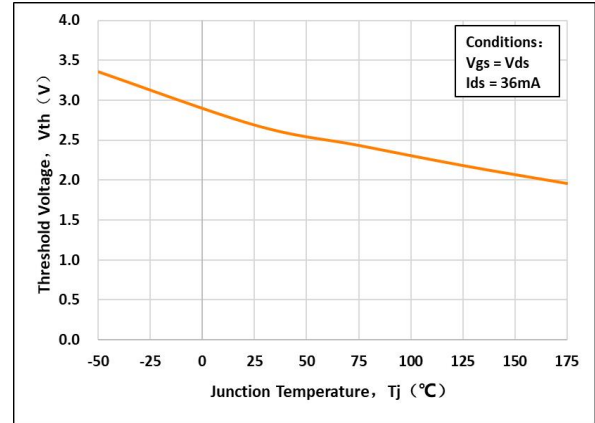


Figure 11: 3rd Quadrant Characteristic ( $T_J = -55^\circ\text{C}$ )

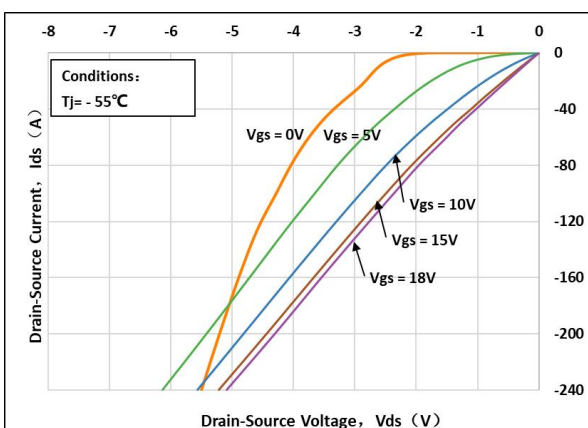
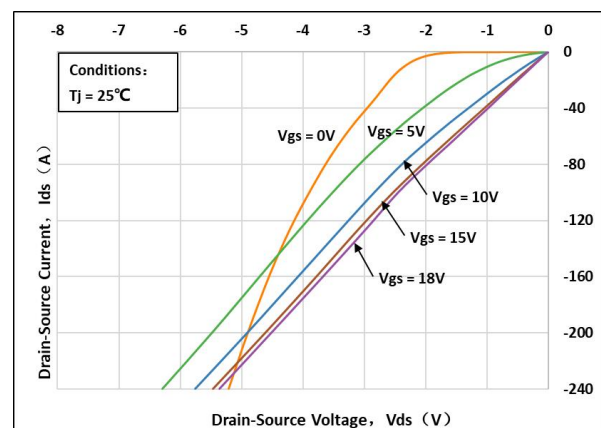


Figure 12: 3rd Quadrant Characteristic ( $T_J = 25^\circ\text{C}$ )



## Typical Characteristics Curves ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

Figure 13: 3rd Quadrant Characteristic( $T_J=175^\circ\text{C}$ )

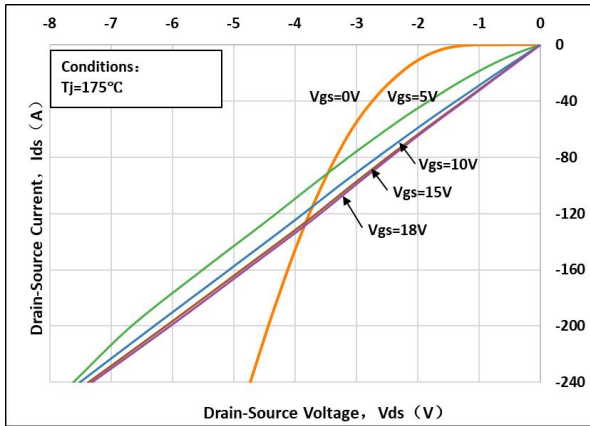


Figure 14: Gate Charge Characteristics

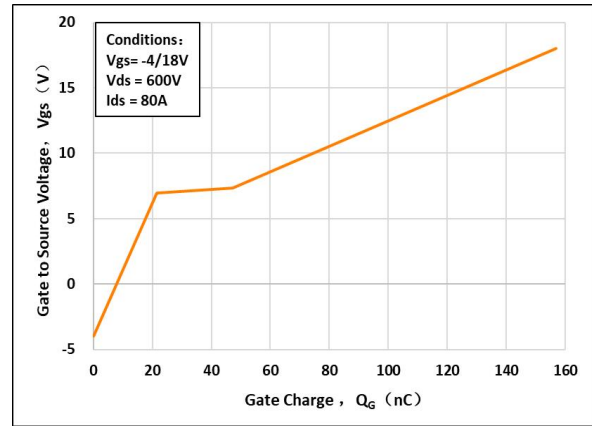


Figure 15: Drain Current vs. Case Temperature

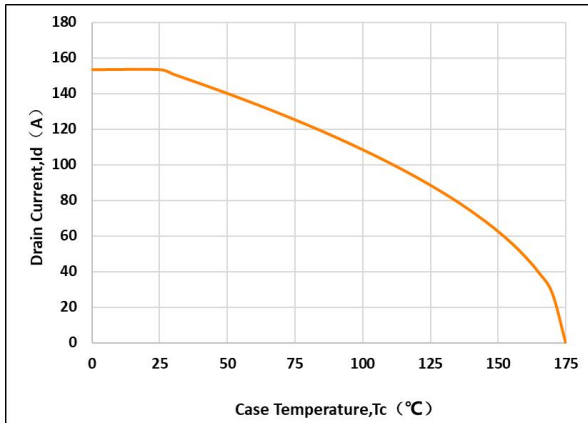


Figure 16: Safe Operating Area

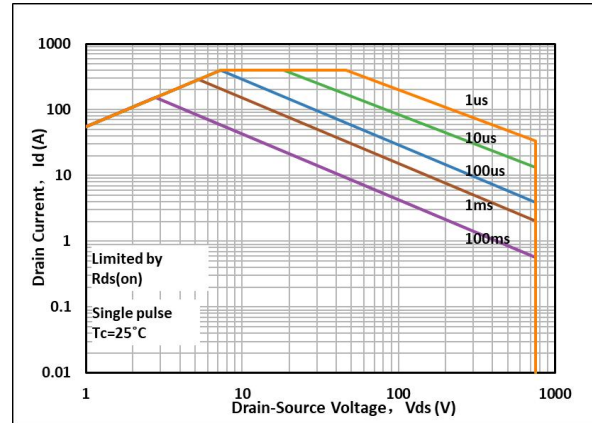


Figure 17: Capacitance Characteristics

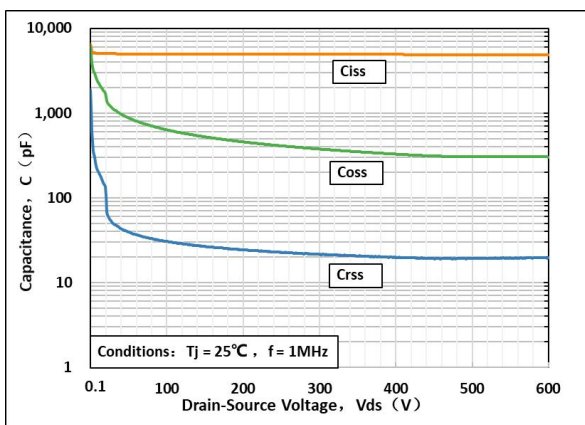
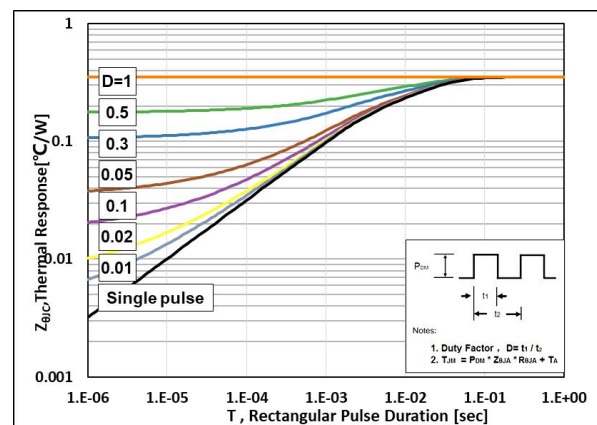
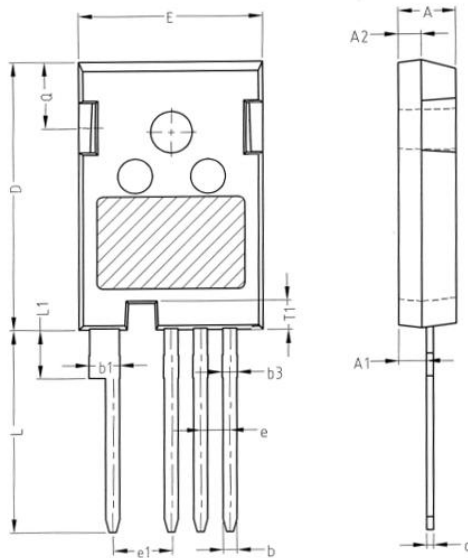


Figure 18: Transient Thermal Impedance



## Package Outline Dimensions (Unit: millimeters)

### TO-247-4L



COMMON DIMENSIONS

| SYMBOL    | MM       |       |       |
|-----------|----------|-------|-------|
|           | MIN      | NOM   | MAX   |
| A         | 4.80     | 5.00  | 5.20  |
| A1        | 2.21     | 2.41  | 2.61  |
| A2        | 1.80     | 2.00  | 2.20  |
| b         | 1.06     | 1.21  | 1.36  |
| b1        | 2.33     | 2.63  | 2.93  |
| b3        | 1.07     | 1.30  | 1.60  |
| c         | 0.51     | 0.61  | 0.75  |
| D         | 23.30    | 23.45 | 23.60 |
| D1        | 16.25    | 16.55 | 16.85 |
| E         | 15.74    | 15.94 | 16.14 |
| E1        | 13.72    | 14.02 | 14.32 |
| T1        | 2.35     | 2.50  | 2.65  |
| e         | 2.54 BSC |       |       |
| e1        | 5.08 BSC |       |       |
| Q         | 5.49     | 5.79  | 6.09  |
| L         | 17.27    | 17.57 | 17.87 |
| L1        | 3.99     | 4.19  | 4.39  |
| $\Phi P$  | 3.40     | 3.60  | 3.80  |
| $\Phi P1$ | 7.19 REF |       |       |

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