

## Super-Junction Power MOSFET

### 1. Product Information

#### Features

- Low FOM  $R_{DS(ON)} \times Q_G$
- Better EMI
- Extremely low switching loss
- Good stability and uniformity
- 100% UIS and Isolation Tested

#### Pin Description

| Pin | Description |
|-----|-------------|
| 1   | Gate(G)     |
| 2   | Drain(D)    |
| 3   | Source(S)   |

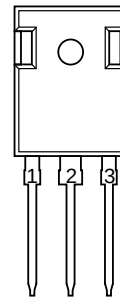
#### Applications

- Swit Mode Power Supply (SMPS)
- Uninterruptible Power Supply (UPS)
- Power Factor Correction (PFC)
- Charge

#### Quick reference

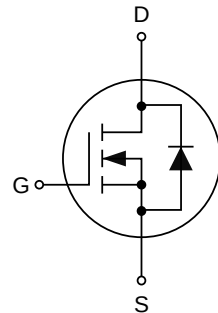
- $V_{DS} \geq 650\text{ V}$
- $I_D \leq 20\text{ A}$
- $R_{DS(ON)} \leq 190\text{ m}\Omega @ V_{GS} = 10\text{ V}$  (Type 160 m $\Omega$ )

#### Simplified Outline



Top View  
TO-247

#### Symbol



#### Package Marking and Ordering Information

| Product Name | Marking    | Package | Packaging | Quantity (pcs) |
|--------------|------------|---------|-----------|----------------|
| KJC65R190P   | KJC65R190P | TO-247  | Tube      | 30             |

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

| Symbol          | Parameter                                            | Values     | Unit               |
|-----------------|------------------------------------------------------|------------|--------------------|
| $V_{DS}$        | Drain-Source Voltage                                 | 650        | V                  |
| $V_{GS}$        | Gate-Source Voltage                                  | $\pm 30$   | V                  |
| $I_D$           | Continuous Drain Current ( $T_C=25^\circ\text{C}$ )  | 20         | A                  |
|                 | Continuous Drain Current ( $T_C=100^\circ\text{C}$ ) | 12.5       | A                  |
| $I_{DM}$        | Pulsed Drain Current <sup>[1]</sup>                  | 80         | A                  |
| $E_{AS}$        | Single Pulsed Avalanche Energy <sup>[2]</sup>        | 388        | mJ                 |
| $P_D$           | Power Dissipation <sup>[2]</sup>                     | 219        | W                  |
| $dv/dt$         | Peak Diode Recovery $dv/dt$                          | 5          | V/ns               |
| $T_J, T_{stg}$  | Operating Junction and Storage Temperature Range     | -55 to 150 | $^\circ\text{C}$   |
| $R_{\theta JA}$ | Thermal Resistance, Junction-Ambient <sup>[3]</sup>  | 45         | $^\circ\text{C/W}$ |
| $R_{\theta JC}$ | Thermal Resistance, Junction-Case <sup>[3]</sup>     | 0.57       | $^\circ\text{C/W}$ |

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

| Symbol                             | Parameter                                 | Test Conditions                                                                          | Min | Type | Max  | Unit |
|------------------------------------|-------------------------------------------|------------------------------------------------------------------------------------------|-----|------|------|------|
| Static Characteristics             |                                           |                                                                                          |     |      |      |      |
| BV <sub>DSS</sub>                  | Drain-Source Breakdown Voltage            | V <sub>GS</sub> =0 V, I <sub>D</sub> =250 μA                                             | 650 | -    | -    | V    |
| I <sub>DSS</sub>                   | Zero Gate Voltage Drain Current           | V <sub>DS</sub> =650 V, V <sub>GS</sub> =0 V, T <sub>J</sub> =25°C                       | -   | -    | 1    | μA   |
| I <sub>GSS</sub>                   | Gate-Body Leakage Current                 | V <sub>GS</sub> =±30 V, V <sub>DS</sub> =0 V                                             | -   | -    | ±100 | nA   |
| V <sub>GS(th)</sub>                | Gate Threshold Voltage                    | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250 μA                                | 2.5 | 3.5  | 4.5  | V    |
| R <sub>DS(ON)</sub>                | Drain-Source On-State Resistance          | V <sub>GS</sub> =10 V, I <sub>D</sub> =20 A                                              | -   | 160  | 190  | mΩ   |
| Dynamic Characteristics            |                                           |                                                                                          |     |      |      |      |
| C <sub>iss</sub>                   | Input Capacitance                         | V <sub>DS</sub> =100 V, V <sub>GS</sub> =0 V, F=1 MHz                                    | -   | 1655 | -    | pF   |
| C <sub>oss</sub>                   | Output Capacitance                        |                                                                                          | -   | 69   | -    | pF   |
| C <sub>rss</sub>                   | Reverse Transfer Capacitance              |                                                                                          | -   | 1.2  | -    | pF   |
| Switching Characteristics          |                                           |                                                                                          |     |      |      |      |
| t <sub>d(on)</sub>                 | Turn-on Delay Time                        | V <sub>DS</sub> =325 V, I <sub>D</sub> =20 A, R <sub>G</sub> =25 Ω, V <sub>GS</sub> =10V | -   | 34   | -    | ns   |
| t <sub>r</sub>                     | Turn-on Rise Time                         |                                                                                          | -   | 37   | -    | ns   |
| t <sub>d(off)</sub>                | Turn-off Delay Time                       |                                                                                          | -   | 148  | -    | ns   |
| t <sub>f</sub>                     | Turn-off Fall Time                        |                                                                                          | -   | 36   | -    | ns   |
| Q <sub>g</sub>                     | Total Gate Charge                         | V <sub>DS</sub> =325 V, I <sub>D</sub> =20 A, V <sub>GS</sub> =10 V                      | -   | 34   | -    | nC   |
| Q <sub>gs</sub>                    | Gate-Source Charge                        |                                                                                          | -   | 7    | -    | nC   |
| Q <sub>gd</sub>                    | Gate-Drain Charge                         |                                                                                          | -   | 12   | -    | nC   |
| Source-Drain Diode Characteristics |                                           |                                                                                          |     |      |      |      |
| V <sub>SD</sub>                    | Drain-Source Diode Forward Voltage        | V <sub>GS</sub> =0V, I <sub>F</sub> =20 A                                                | -   | -    | 1.4  | V    |
| I <sub>S</sub>                     | Diode Continuous Forward Current          |                                                                                          | -   | -    | 20   | A    |
| I <sub>SM</sub>                    | Maximum Pulsed Body-Diode Forward Current |                                                                                          | -   | -    | 60   | A    |
| T <sub>rr</sub>                    | Reverse Recovery Time                     | V <sub>R</sub> =50 V, I <sub>F</sub> =20 A, di/dt=100 A/μs                               | -   | 301  | -    | ns   |
| Q <sub>rr</sub>                    | Reverse Recovery Charge                   |                                                                                          | -   | 4.47 | -    | μC   |

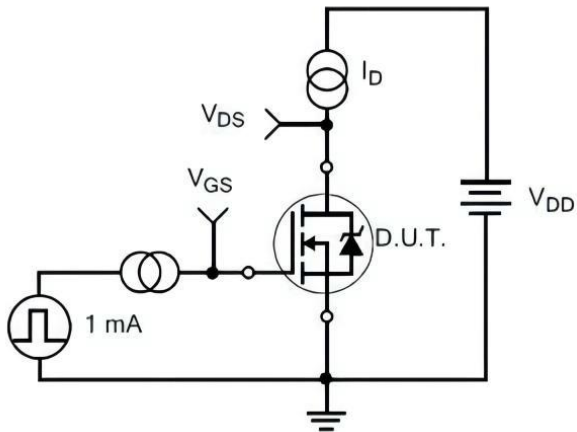
Notes:

- Limited by maximum junction temperature, maximum duty cycle is 0.75.
- T<sub>J</sub>=25°C, V<sub>DD</sub>=50 V, V<sub>GS</sub>=10 V, R<sub>G</sub>=25 Ω.
- Mount on minimum PCB layout.

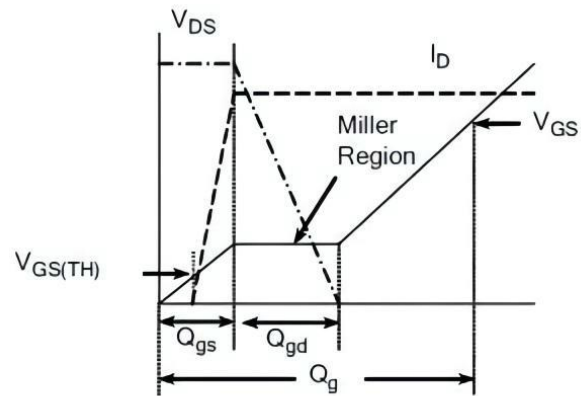
## 4. Test Circuits and Waveforms ( $T_J=25^{\circ}\text{C}$ , unless otherwise noted)

**Table 1. Gate Charge Test Circuit and Waveforms**

**Gate Charge Test Circuit**

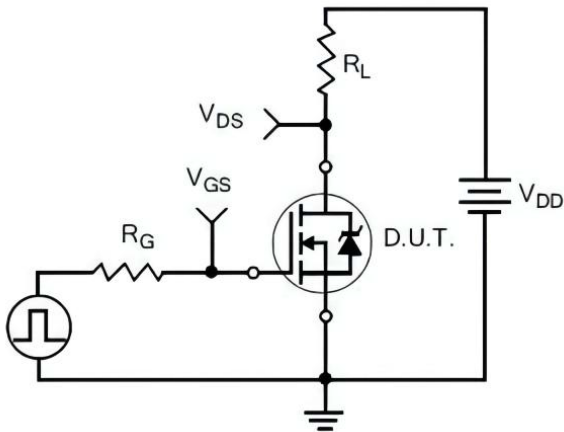


**Gate Charge Waveforms**

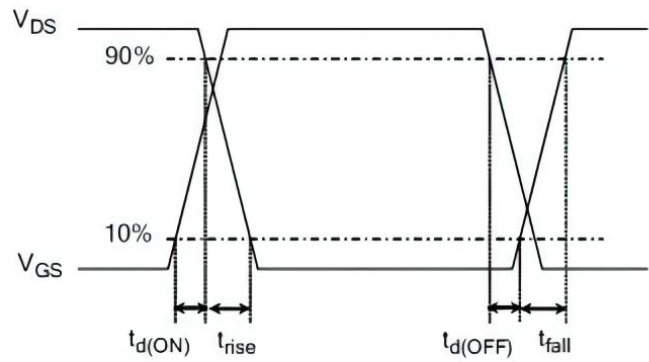


**Table 2. Resistive Switching Test Circuit and Waveforms**

**Resistive Switching Test Circuit**

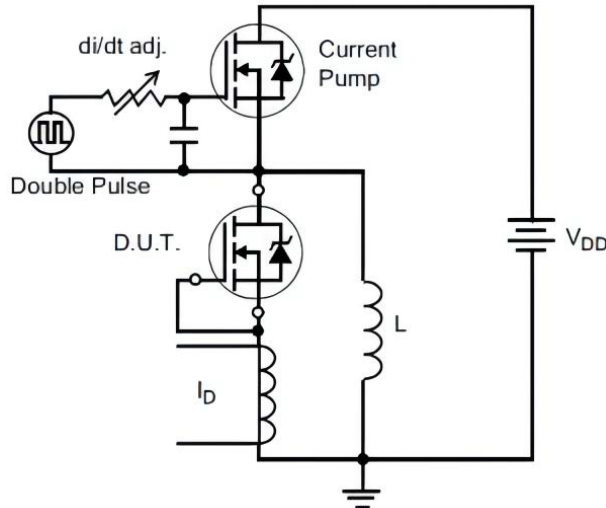


**Resistive Switching Waveforms**

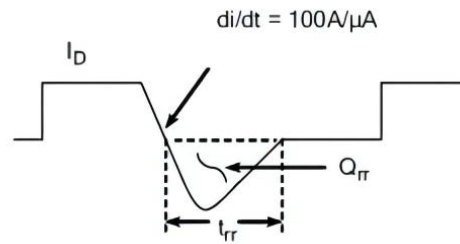


**Table 3. Diode Recovery Test Circuit and Waveforms**

**Diode Recovery Test Circuit**

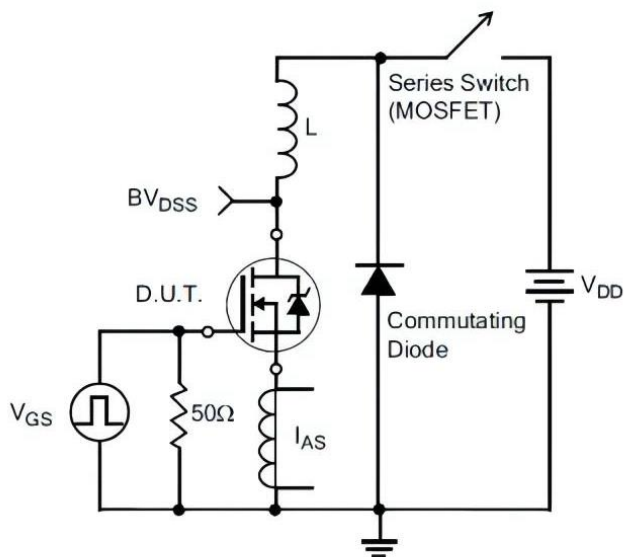


**Diode Recovery Waveforms**

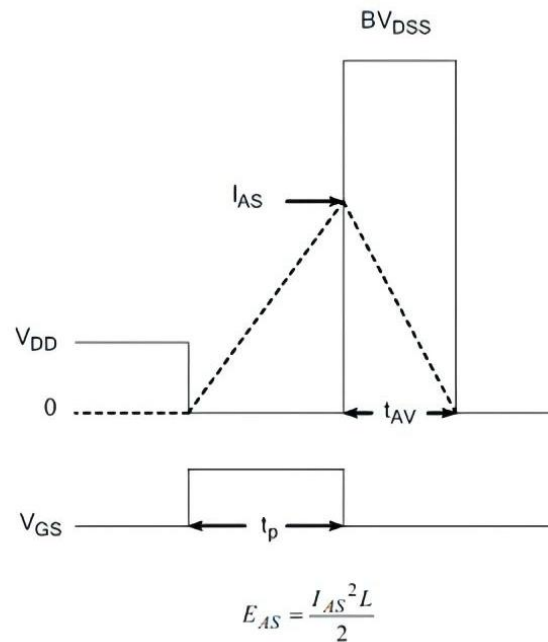


**Table 4. Unclamped inductive Switching (UIS) Test Circuit and Waveforms**

**Unclamped Inductive Switching Test Circuit**



**Unclamped Inductive Switching Waveforms**



## 5. Electrical Characteristics

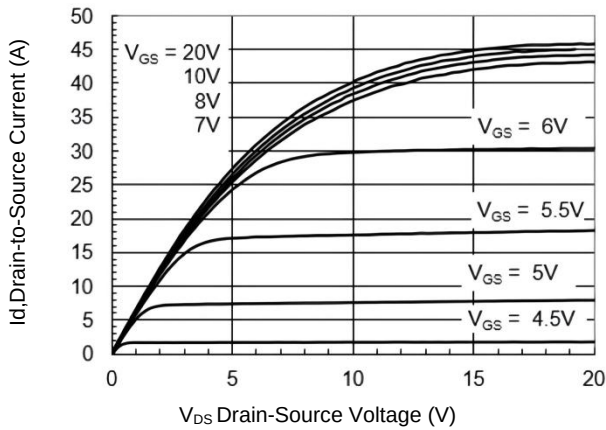


Figure 1. Typical Output Characteristics

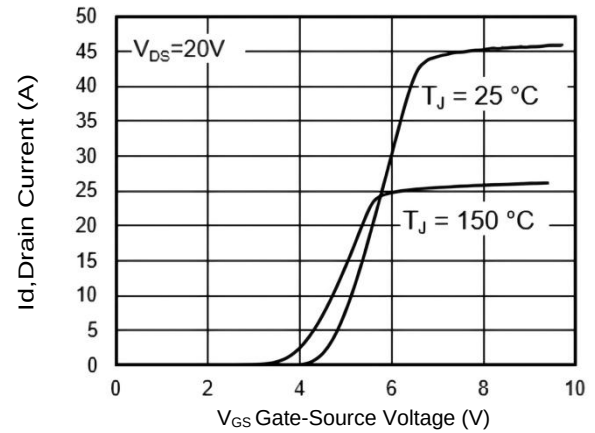


Figure 2. Typical Transfer Characteristics

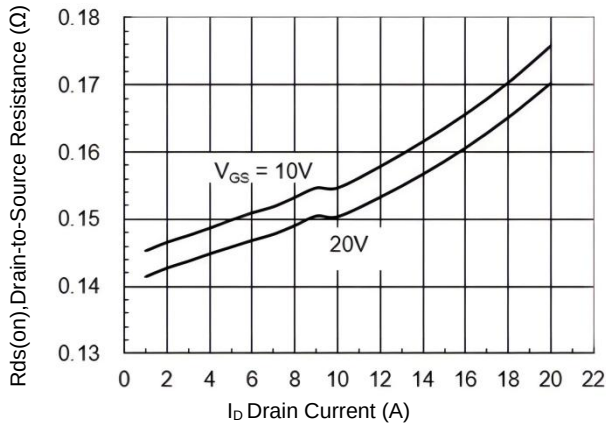


Figure 3. On-Resistance versus Drain Current

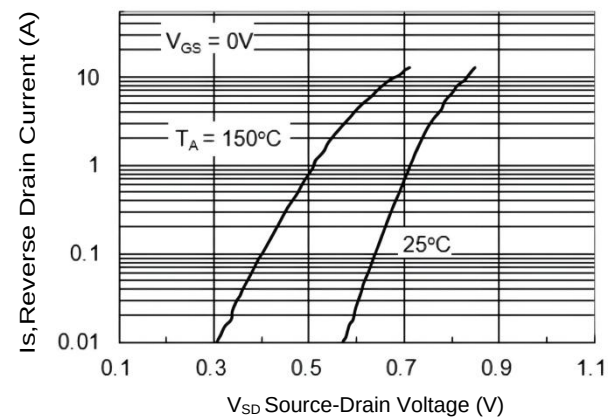


Figure 4. Diode forward voltage versus Current

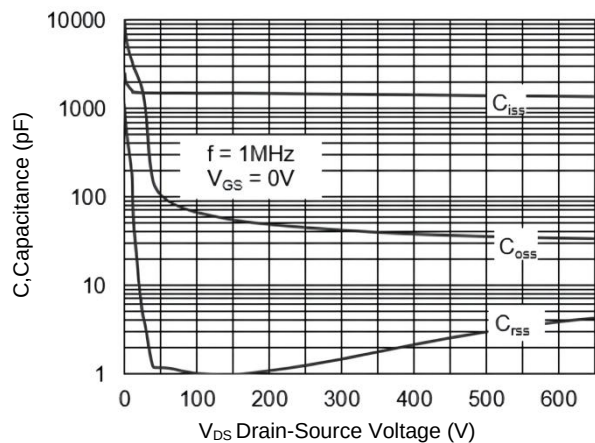


Figure 5. Typical Capacitance versus  $V_{DS}$

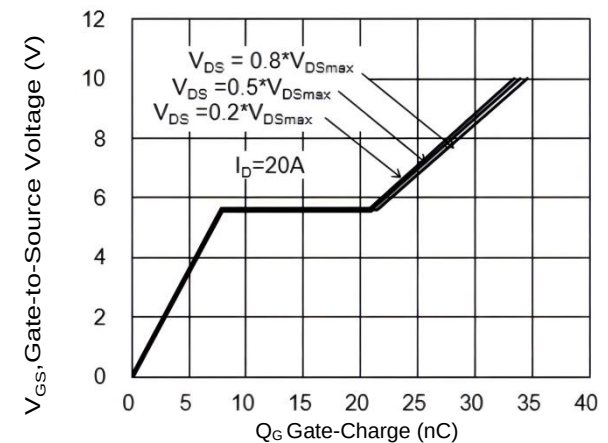


Figure 6. Typical Gate Charge versus  $V_{GS}$

## 5. Electrical Characteristics (cont.)

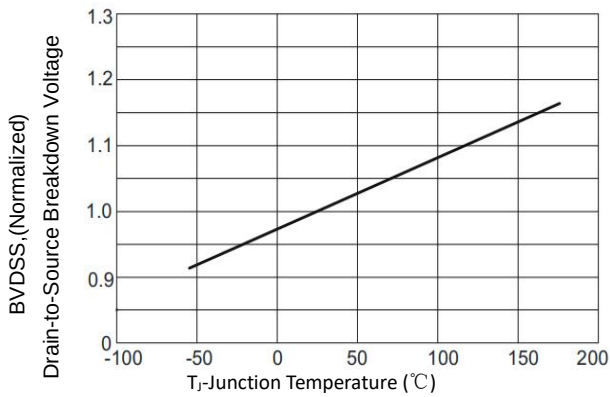


Figure 7. BV<sub>DSS</sub> Variation with Temperature

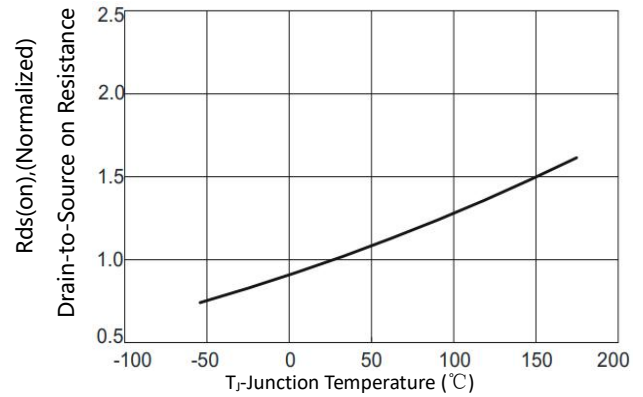


Figure 8. On-Resistance Variation with Temperature

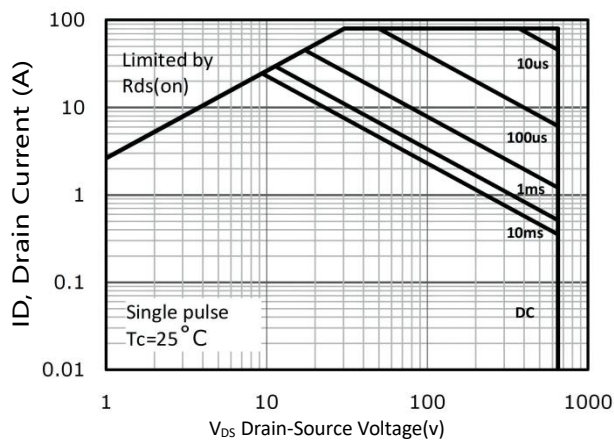


Figure9. Maximum Safe Operating Area

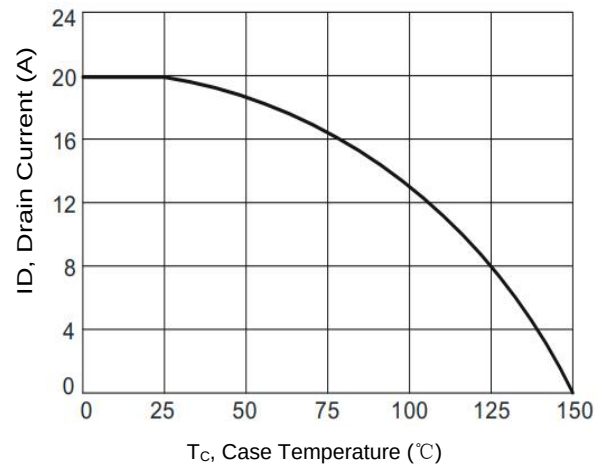
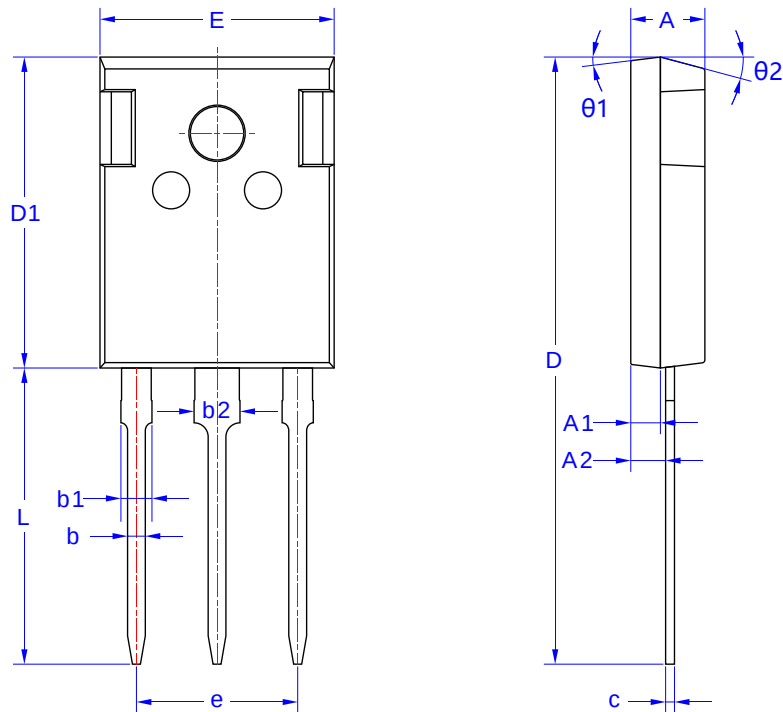


Figure 10. Maximum Continuous Drain Current versus Case Temperature

## 6. Package Mechanical Data

### ● TO-247 Package



| Symbol | Dimensions in Millimeters |       |       |
|--------|---------------------------|-------|-------|
|        | MIN.                      | NOM.  | MAX.  |
| A      | 4.90                      | 5.00  | 5.10  |
| A1     | 1.90                      | 2.00  | 2.10  |
| A2     | 2.25                      | 2.35  | 2.45  |
| b      |                           | 1.20  |       |
| b1     |                           | 2.10  |       |
| b2     |                           | 3.10  |       |
| c      |                           | 0.60  |       |
| D      | 40.00                     | 41.00 | 42.00 |
| D1     | 20.80                     | 21.00 | 21.20 |
| E      | 15.60                     | 15.80 | 16.00 |
| e      |                           | 10.88 |       |
| L      | 19.80                     | 20.00 | 20.20 |
| θ1     |                           | 7°    |       |
| θ2     |                           | 15°   |       |