

## FEATURES

High Speed Switching  
High Blocking Voltage with Low  $R_{DS(on)}$   
Easy to Parallel  
Simple to Drive  
RoHS Compliant

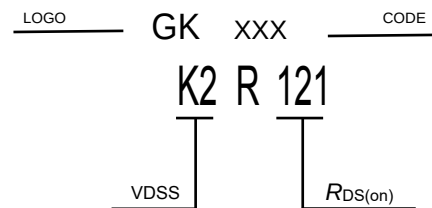
## BENEFITS

Increased Power Density  
Faster Operating Frequency  
Reduction of Heat Sink Requirements  
Higher Efficiency  
Reduced EMI

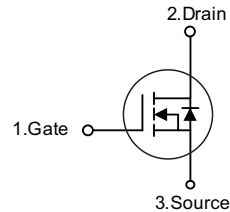
## APPLICATION

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

$V_{DS}$  1200V  
 $I_D$  26 A  
 $R_{DS(on)}$  121 mΩ



TO-247-3



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

| Symbol      | Parameter                                   | Test Conditions                                                              | Value     | Unit             |
|-------------|---------------------------------------------|------------------------------------------------------------------------------|-----------|------------------|
| $V_{DS}$    | Drain-Source Voltage                        |                                                                              | 1200      | V                |
| $I_D$       | Continuous Drain Current                    | $V_{GS}=18\text{V}$<br>$T_C=25^\circ\text{C}$<br>$T_C=100^\circ\text{C}$     | 26<br>18  | A                |
| $I_{DM}$    | Peak Drain Current                          | Pulse width $t_p$ limited by $T_{jmax}$                                      | 48        | A                |
| $V_{GSmax}$ | Gate-Source Voltage, max. Transient Voltage | $t_p \leq 0.5\mu\text{s}$ , $D < 0.001$                                      | -10/+22   | V                |
| $V_{GSmax}$ | Gate-Source Voltage                         |                                                                              | -8/+22    | V                |
| $V_{GSop}$  | Recommend Gate-Source Voltage               |                                                                              | -4/+18    | V                |
| $P_{tot}$   | Power Dissipation                           | $T_C=25^\circ\text{C}$<br>$T_C=100^\circ\text{C}$                            | 161<br>80 | W                |
| $E_{AS}$    | Non-Repetitive Avalanche Switching Energy   | $V_{DD}=50\text{V}$ , $L=1\text{mH}$ , $I_D=23\text{A}$                      | 264       | mJ               |
| $E_{AR}$    | Repetitive Avalanche Energy                 | $V_{DD}=50\text{V}$ , $L=660\mu\text{H}$ , $I_D=23\text{A}$                  | 174       | mJ               |
| $t_{SC}$    | Short-Circuit Withstand Time                | $V_{DD}=800\text{V}$ , $V_{GS}=18\text{V}$ ,<br>$V_{DS,peak} < 1200\text{V}$ | 1.8       | $\mu\text{s}$    |
| $T_j$       | Operating Junction Temperature              |                                                                              | -40~175   | $^\circ\text{C}$ |
| $T_{stg}$   | Storage Temperature                         |                                                                              | -40~150   | $^\circ\text{C}$ |
| $T_{sld}$   | Soldering Temperature                       | 1.6mm (0.063") from case for 10s                                             | 260       | $^\circ\text{C}$ |
| $M$         | Mounting Torque                             | M3 screw                                                                     | 0.6       | Nm               |

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

### Static Characteristics

| Symbol        | Parameter                        | Test Conditions                                                                                 | Value |            |      | Unit             |
|---------------|----------------------------------|-------------------------------------------------------------------------------------------------|-------|------------|------|------------------|
|               |                                  |                                                                                                 | Min.  | Typ.       | Max. |                  |
| $V_{(BR)DSS}$ | Drain-Source Breakdown Voltage   | $I_D=100\mu\text{A}$ , $V_{GS}=0\text{V}$                                                       | 1200  |            |      | V                |
| $I_{DSS}$     | Zero Gate Voltage Drain Current  | $V_{DS}=1200\text{V}$ , $V_{GS}=0\text{V}$                                                      |       | 1          | 10   | $\mu\text{A}$    |
| $I_{GSS}$     | Gate-Source Leakage Current      | $V_{DS}=0\text{V}$ , $V_{GS}=18\text{V}$                                                        |       |            | 250  | nA               |
| $V_{GS(th)}$  | Gate Threshold Voltage           | $V_{DS}=V_{GS}$ , $I_D=2.5\text{mA}$<br>$T_j=25^{\circ}\text{C}$<br>$T_j=175^{\circ}\text{C}$   | 2     | 2.8<br>2.0 | 4    | V                |
| $R_{DS(on)}$  | Drain-Source On-State Resistance | $V_{GS}=18\text{V}$ , $I_D=10\text{A}$<br>$T_j=25^{\circ}\text{C}$<br>$T_j=175^{\circ}\text{C}$ |       | 121<br>206 | 160  | $\text{m}\Omega$ |
| $g_{fs}$      | Forward Transconductance         | $V_{DS}=20\text{V}$ , $I_D=10\text{A}$                                                          |       | 6          |      | S                |

### Dynamic Characteristics

| Symbol       | Parameter                    | Test Conditions                                                        | Value |      |      | Unit          |
|--------------|------------------------------|------------------------------------------------------------------------|-------|------|------|---------------|
|              |                              |                                                                        | Min.  | Typ. | Max. |               |
| $C_{iss}$    | Input Capacitance            | $V_{DS}=1000\text{V}$ ,<br>$f=1\text{MHz}$ ,<br>$V_{GS}=0\text{V}$     |       | 692  |      | pF            |
| $C_{oss}$    | Output Capacitance           |                                                                        |       | 39   |      | pF            |
| $C_{rss}$    | Reverse Transfer Capacitance |                                                                        |       | 4    |      | pF            |
| $E_{oss}$    | $C_{oss}$ Stored Energy      |                                                                        |       | 23   |      | $\mu\text{J}$ |
| $R_{G(int)}$ | Internal Gate Resistance     | $f=1\text{MHz}$                                                        |       | 1.9  |      | $\Omega$      |
| $Q_g$        | Total Gate Charge            | $V_{DS}=800\text{V}$ ,<br>$I_D=10\text{A}$ ,<br>$V_{GS}=-4/18\text{V}$ |       | 37   |      | nC            |
| $Q_{gs}$     | Gate to Source Charge        |                                                                        |       | 9    |      | nC            |
| $Q_{gd}$     | Gate to Drain Charge         |                                                                        |       | 13   |      | nC            |

### Thermal Characteristics

| Symbol        | Parameter                                | Value |      |      | Unit                 |
|---------------|------------------------------------------|-------|------|------|----------------------|
|               |                                          | Min.  | Typ. | Max. |                      |
| $R_{th(j-c)}$ | Thermal Resistance from Junction to Case |       | 0.93 |      | $^{\circ}\text{C/W}$ |

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

### Switching Characteristics

| Symbol       | Parameter           | Test Conditions                                                                                                                                              | Value |      |      | Unit          |
|--------------|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------|------|---------------|
|              |                     |                                                                                                                                                              | Min.  | Typ. | Max. |               |
| $t_{d(on)}$  | Turn-On Delay Time  | $V_{DD}=800\text{V}$ , $I_D=10\text{A}$ ,<br>$V_{GS}=-4\text{V}/18\text{V}$ ,<br>$R_{G(ext)}=2.5\Omega$ ,<br>$L=200\mu\text{H}$ ,<br>$T_j=25^\circ\text{C}$  |       | 11   |      | ns            |
| $t_r$        | Rise Time           |                                                                                                                                                              |       | 23   |      | ns            |
| $t_{d(off)}$ | Turn-Off Delay Time |                                                                                                                                                              |       | 16   |      | ns            |
| $t_f$        | Fall Time           |                                                                                                                                                              |       | 15   |      | ns            |
| $E_{on}$     | Turn-On Energy      |                                                                                                                                                              |       | 189  |      | $\mu\text{J}$ |
| $E_{off}$    | Turn-Off Energy     |                                                                                                                                                              |       | 33   |      | $\mu\text{J}$ |
| $t_{d(on)}$  | Turn-On Delay Time  | $V_{DD}=800\text{V}$ , $I_D=10\text{A}$ ,<br>$V_{GS}=-4\text{V}/18\text{V}$ ,<br>$R_{G(ext)}=2.5\Omega$ ,<br>$L=200\mu\text{H}$ ,<br>$T_j=175^\circ\text{C}$ |       | 10   |      | ns            |
| $t_r$        | Rise Time           |                                                                                                                                                              |       | 25   |      | ns            |
| $t_{d(off)}$ | Turn-Off Delay Time |                                                                                                                                                              |       | 17   |      | ns            |
| $t_f$        | Fall Time           |                                                                                                                                                              |       | 15   |      | ns            |
| $E_{on}$     | Turn-On Energy      |                                                                                                                                                              |       | 252  |      | $\mu\text{J}$ |
| $E_{off}$    | Turn-Off Energy     |                                                                                                                                                              |       | 40   |      | $\mu\text{J}$ |

### Reverse Diode Characteristics

| Symbol   | Parameter                        | Test Conditions                                   | Value |      |      | Unit |
|----------|----------------------------------|---------------------------------------------------|-------|------|------|------|
|          |                                  |                                                   | Min.  | Typ. | Max. |      |
| $V_{SD}$ | Diode Forward Voltage            | $V_{GS}=-4\text{V}$ , $I_{SD}=5\text{A}$          |       | 4.0  |      | V    |
|          |                                  | $T_j=25^\circ\text{C}$                            |       | 3.6  |      |      |
|          |                                  | $T_j=175^\circ\text{C}$                           |       | 4.6  |      |      |
|          |                                  | $V_{GS}=-4\text{V}$ , $I_{SD}=10\text{A}$         |       | 4.0  |      |      |
| $I_S$    | Continuous Diode Forward Current | $V_{GS}=-4\text{V}$                               |       | 25   |      | A    |
|          |                                  | $T_c=25^\circ\text{C}$<br>$T_c=100^\circ\text{C}$ |       | 16   |      |      |

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

### Reverse Diode Characteristics (Continued)

| Symbol    | Parameter                     | Test Conditions                                                                                                                               | Value |      |      | Unit |
|-----------|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|-------|------|------|------|
|           |                               |                                                                                                                                               | Min.  | Typ. | Max. |      |
| $t_{rr}$  | Reverse Recovery Time         | $V_{GS} = -4\text{V}$ , $I_{SD} = 10\text{A}$ ,<br>$V_R = 800\text{V}$ ,<br>$di/dt = 1094\text{A}/\mu\text{s}$ ,<br>$T_j = 25^\circ\text{C}$  |       | 46   |      | ns   |
| $Q_{rr}$  | Reverse Recovery Charge       |                                                                                                                                               |       | 135  |      | nC   |
| $I_{rrm}$ | Peak Reverse Recovery Current |                                                                                                                                               |       | 6.4  |      | A    |
| $t_{rr}$  | Reverse Recovery Time         | $V_{GS} = -4\text{V}$ , $I_{SD} = 10\text{A}$ ,<br>$V_R = 800\text{V}$ ,<br>$di/dt = 1080\text{A}/\mu\text{s}$ ,<br>$T_j = 175^\circ\text{C}$ |       | 50   |      | ns   |
| $Q_{rr}$  | Reverse Recovery Charge       |                                                                                                                                               |       | 252  |      | nC   |
| $I_{rrm}$ | Peak Reverse Recovery Current |                                                                                                                                               |       | 8.9  |      | A    |

RATING AND CHARACTERISTIC CURVES

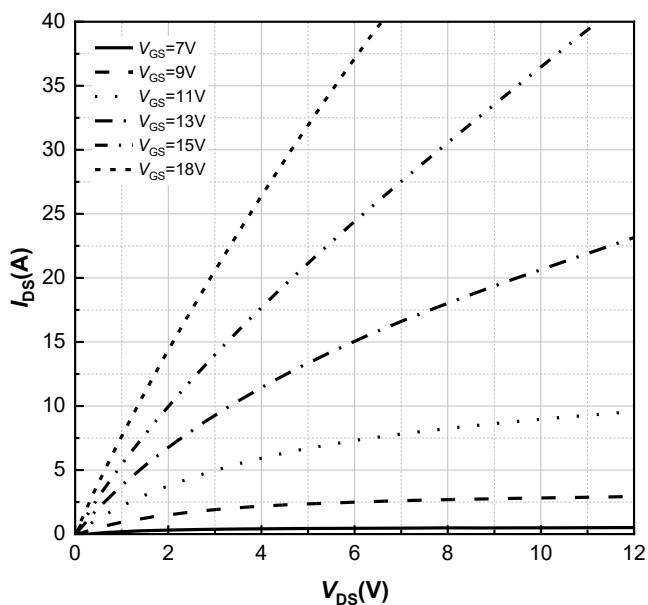


Figure 1. Output Characteristics  
 $T_j = -40^\circ\text{C}$

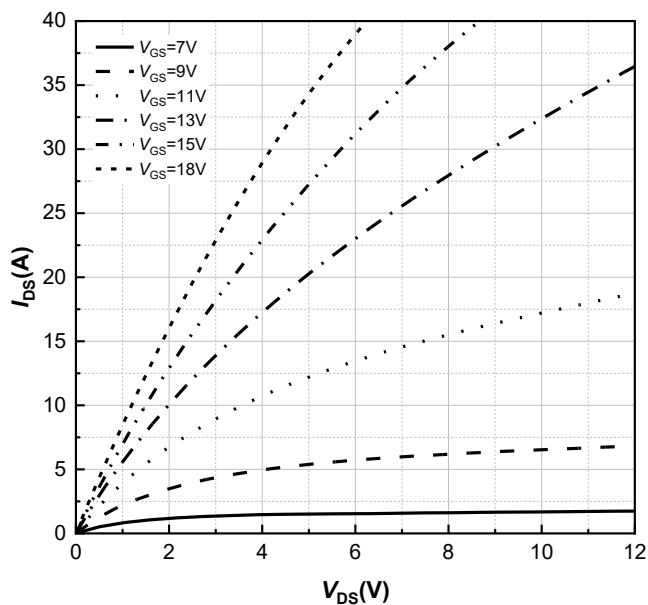


Figure 2. Output Characteristics  
 $T_j = 25^\circ\text{C}$

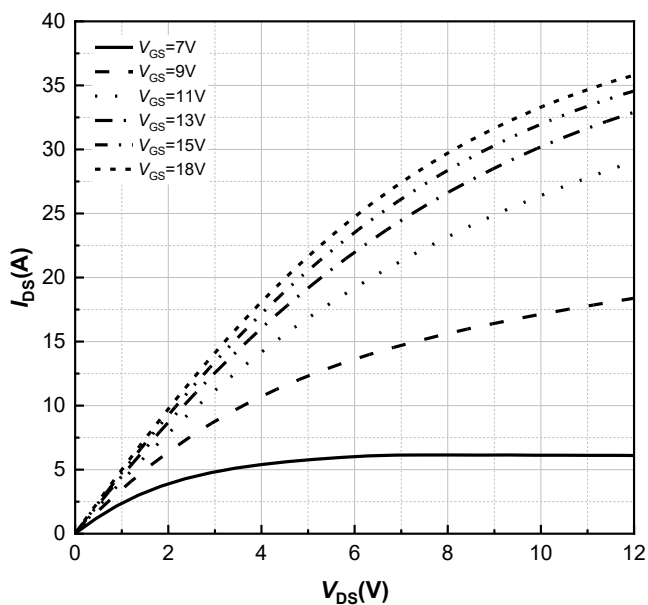


Figure 3. Output Characteristics  
 $T_j = 175^\circ\text{C}$

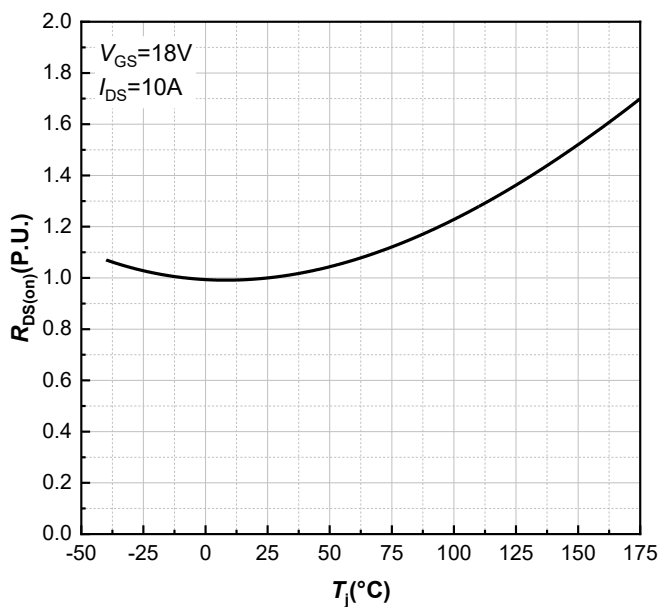


Figure 4. Normalized On-Resistance vs.  
Temperature

RATING AND CHARACTERISTIC CURVES

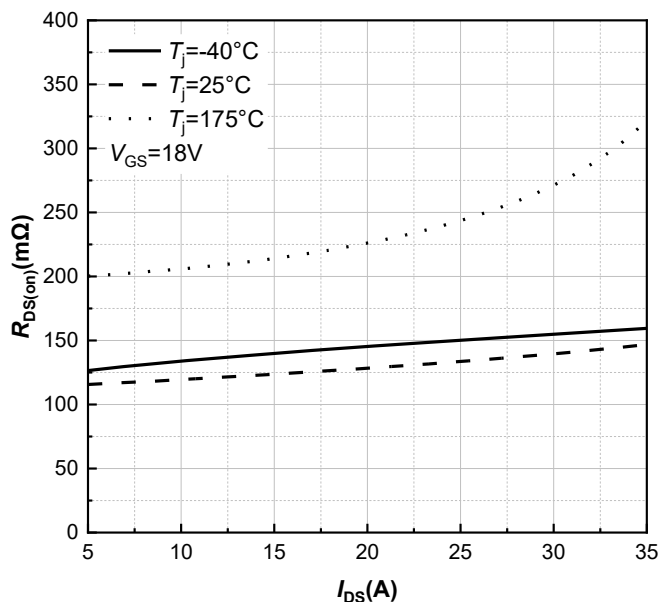


Figure 5. On-Resistance vs. Drain Current For Various Temperatures

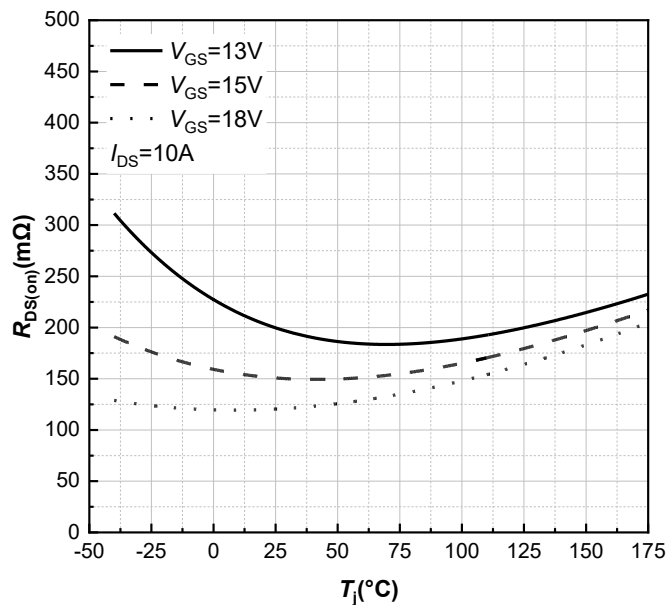


Figure 6. On-Resistance vs. Temperature For Various Gate Voltage

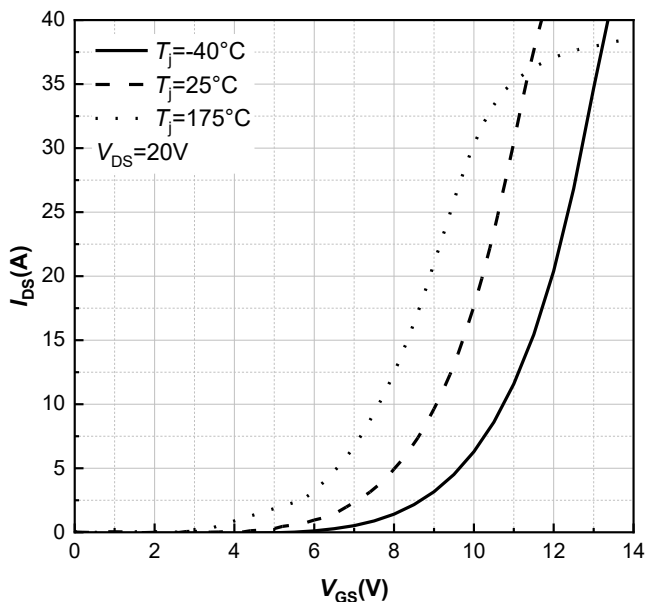


Figure 7. Transfer Characteristic for Various Junction Temperatures

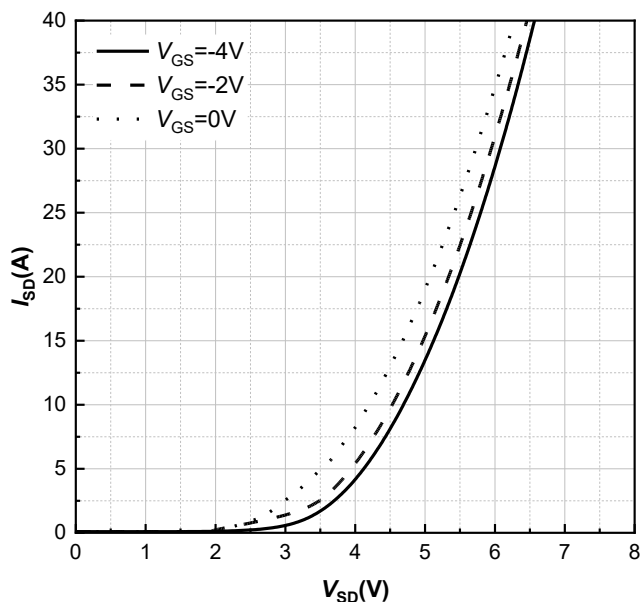


Figure 8. Body Diode Characteristic  $T_J = -40^{\circ}\text{C}$

## RATING AND CHARACTERISTIC CURVES

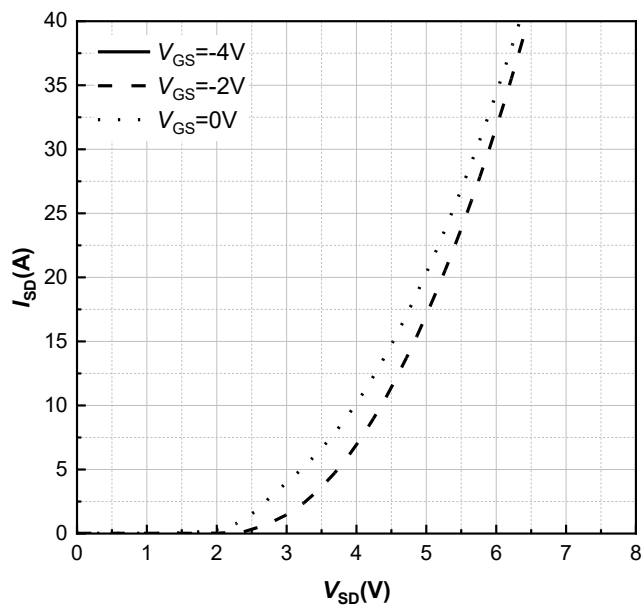


Figure 9. **Body Diode Characteristic**  
 $T_j=25^{\circ}\text{C}$

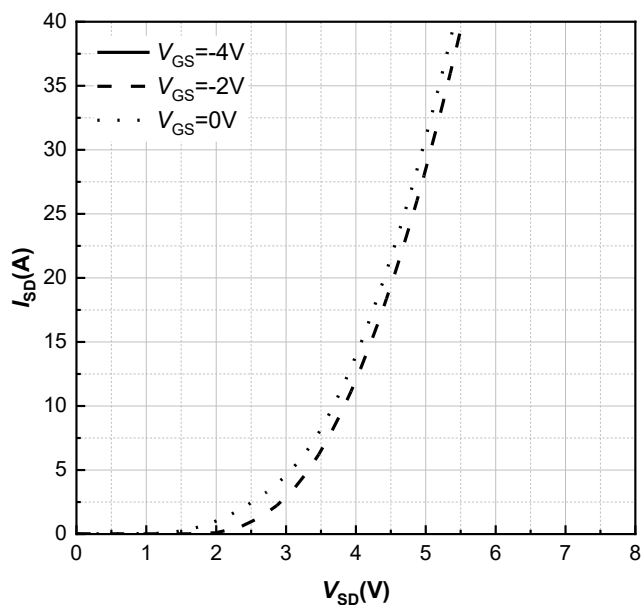


Figure 10. **Body Diode Characteristic**  
 $T_j=175^{\circ}\text{C}$

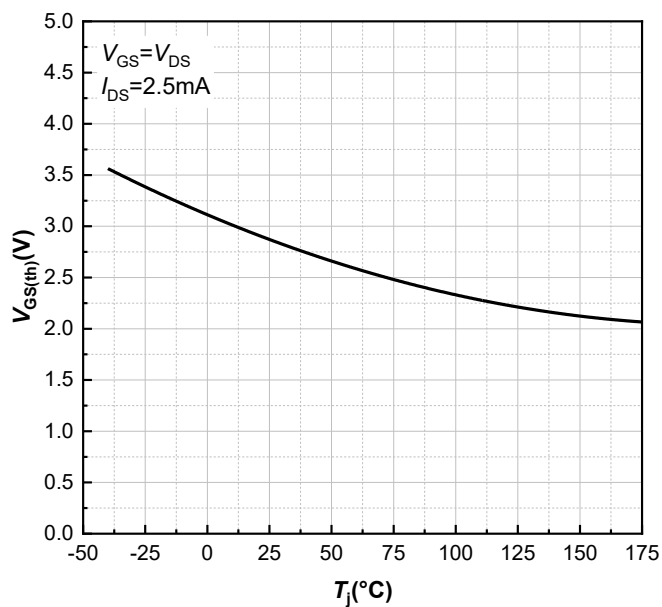


Figure 11. **Threshold Voltage vs. Temperature**

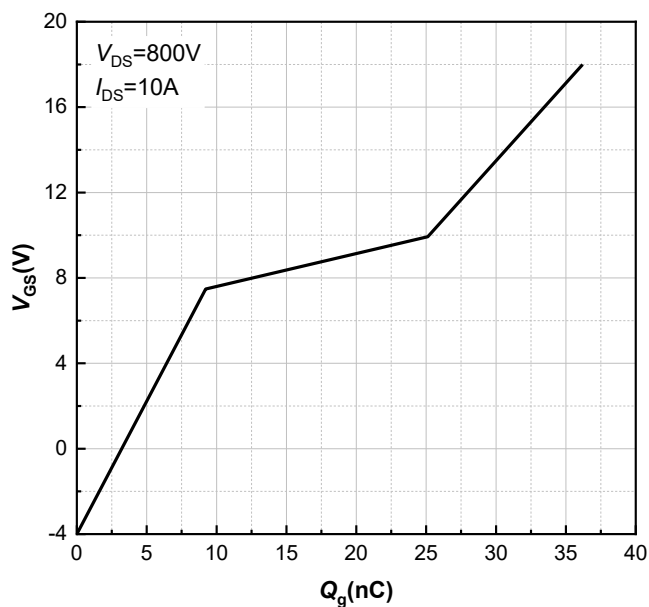


Figure 12. **Gate Charge Characteristics**

RATING AND CHARACTERISTIC CURVES

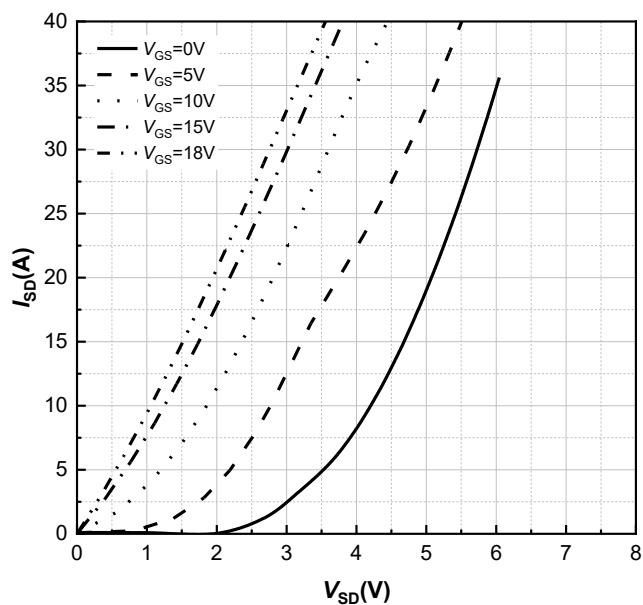


Figure 13. 3rd Quadrant Characteristic  
 $T_j = -40^{\circ}\text{C}$

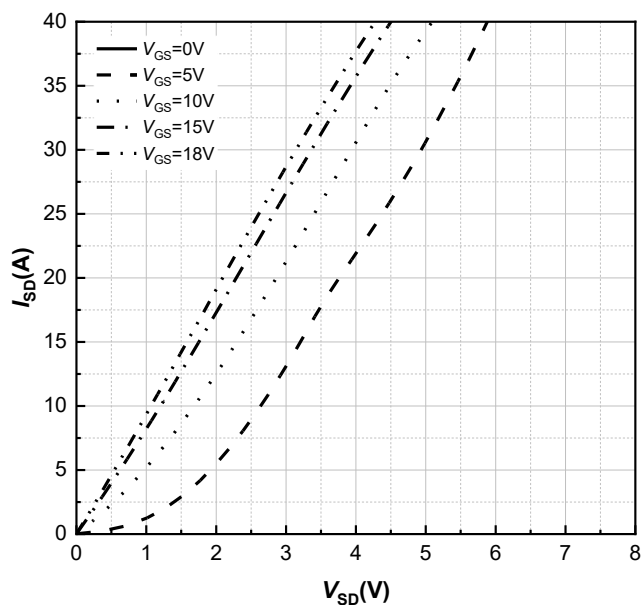


Figure 14. 3rd Quadrant Characteristic  
 $T_j = 25^{\circ}\text{C}$

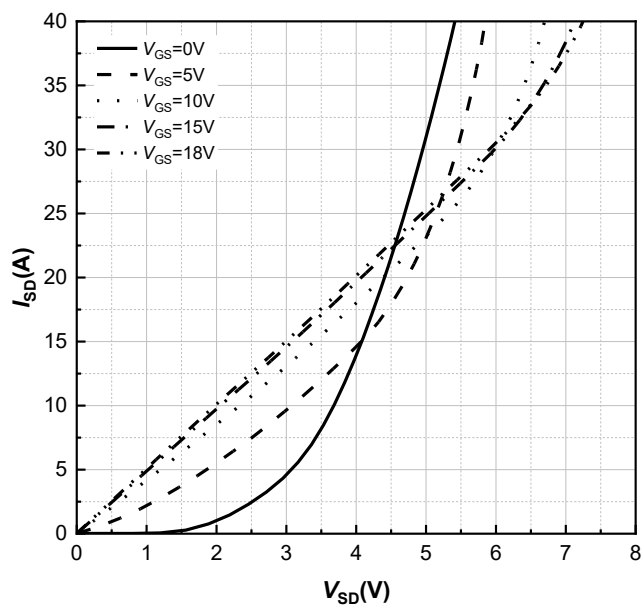


Figure 15. 3rd Quadrant Characteristic  
 $T_j = 175^{\circ}\text{C}$

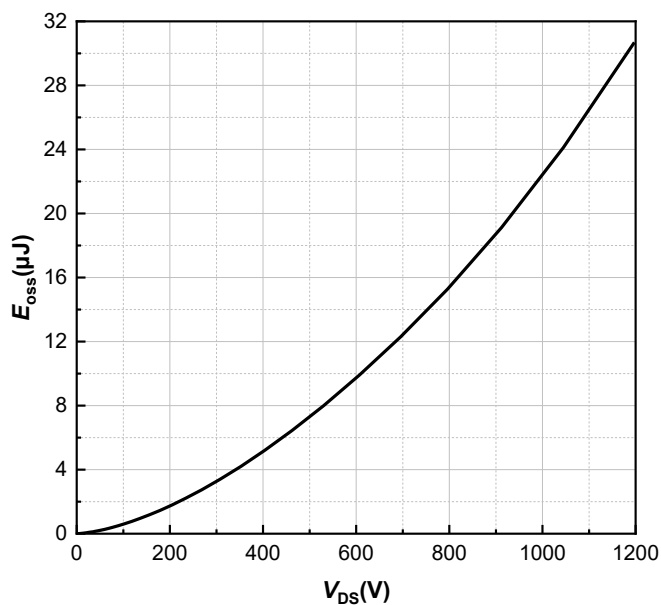


Figure 16. Output Capacitor Stored Energy

## RATING AND CHARACTERISTIC CURVES

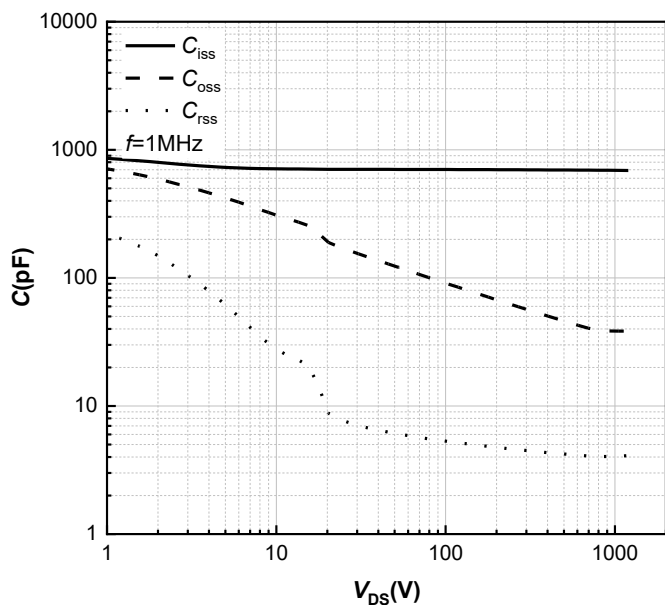


Figure 17. Capacitances vs. Drain-Source

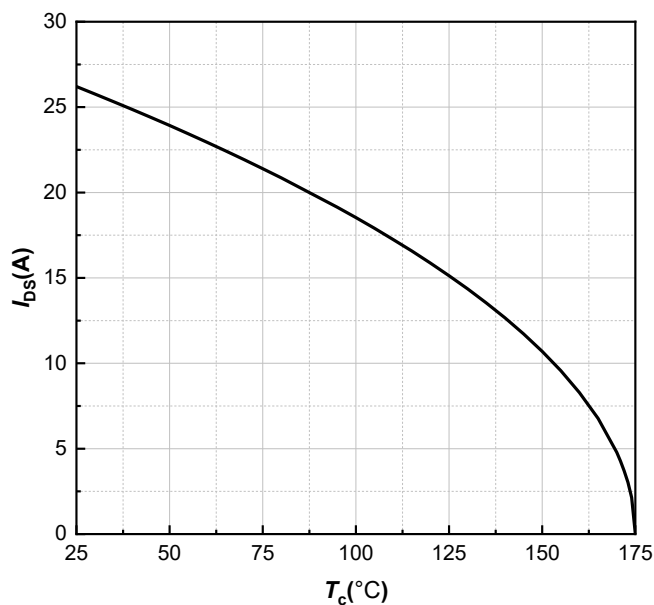


Figure 18. Continuous Drain Current Derating vs. Case Temperature

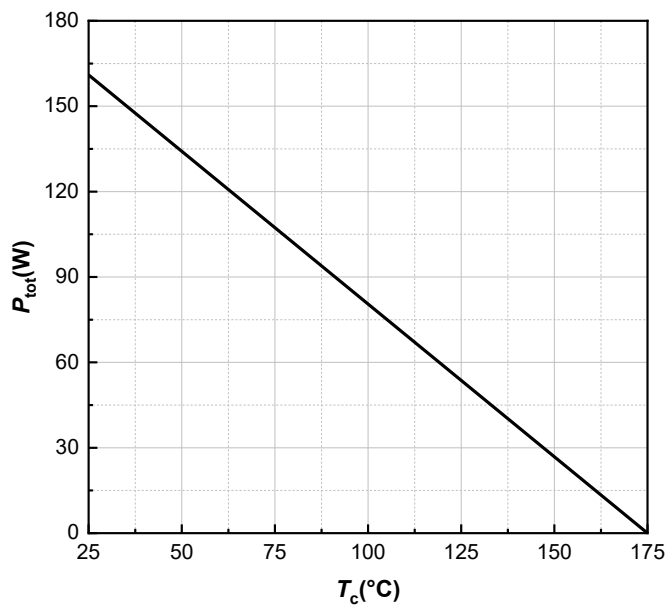


Figure 19. Maximum Power Dissipation Derating vs. Case Temperature

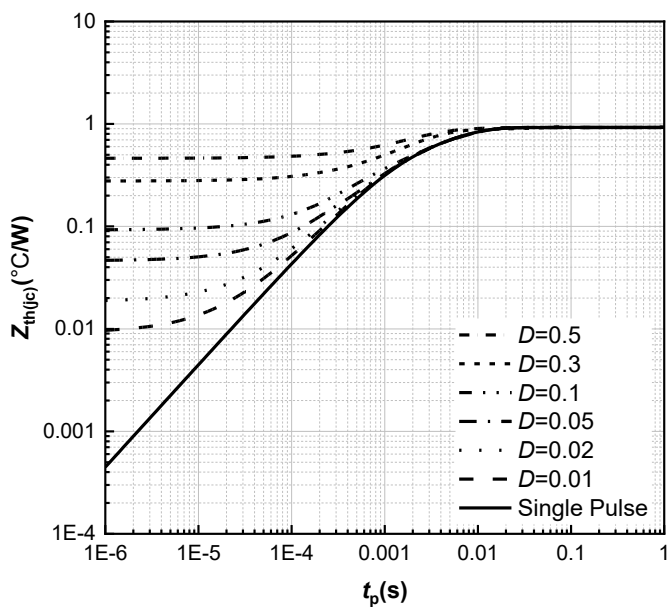


Figure 20. Transient Thermal Impedance

RATING AND CHARACTERISTIC CURVES

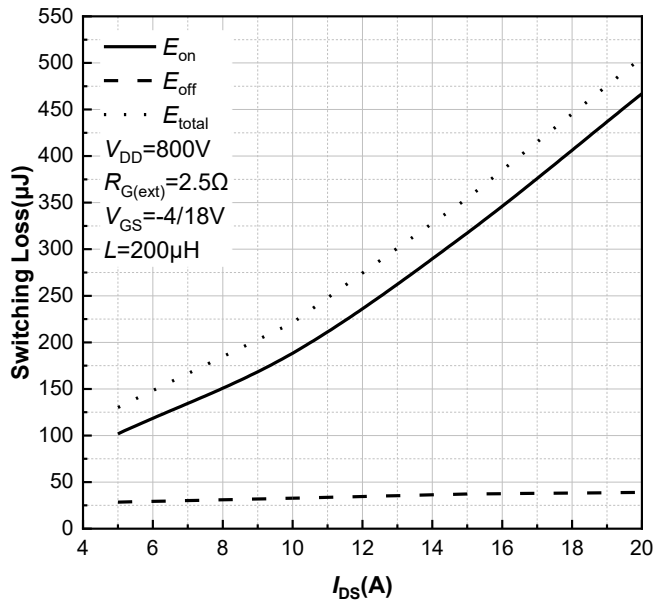


Figure 21. Clamped Inductive Switching  
Energy vs. Drain Current  
 $T_j = 25^\circ\text{C}$

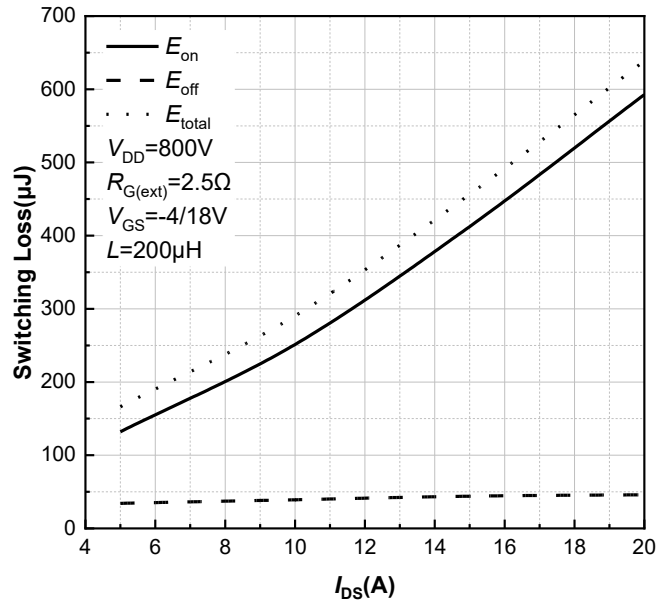


Figure 22. Clamped Inductive Switching  
Energy vs. Drain Current  
 $T_j = 175^\circ\text{C}$

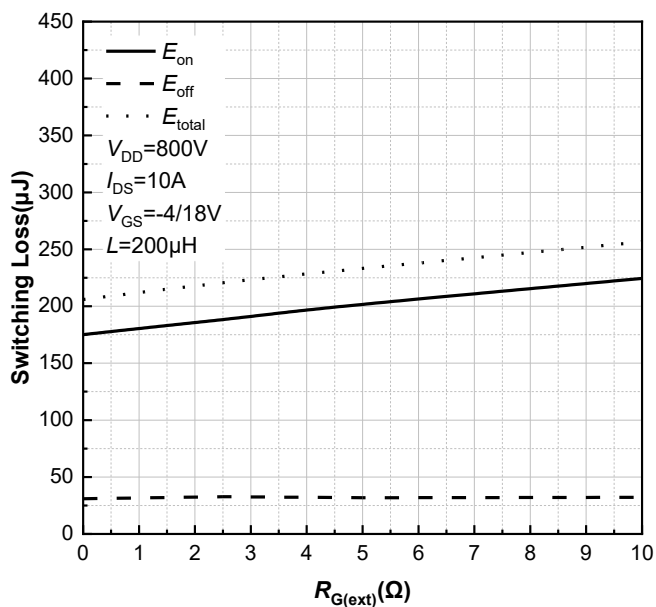


Figure 23. Clamped Inductive Switching  
Energy vs.  $R_{G(\text{ext})}$   
 $T_j = 25^\circ\text{C}$

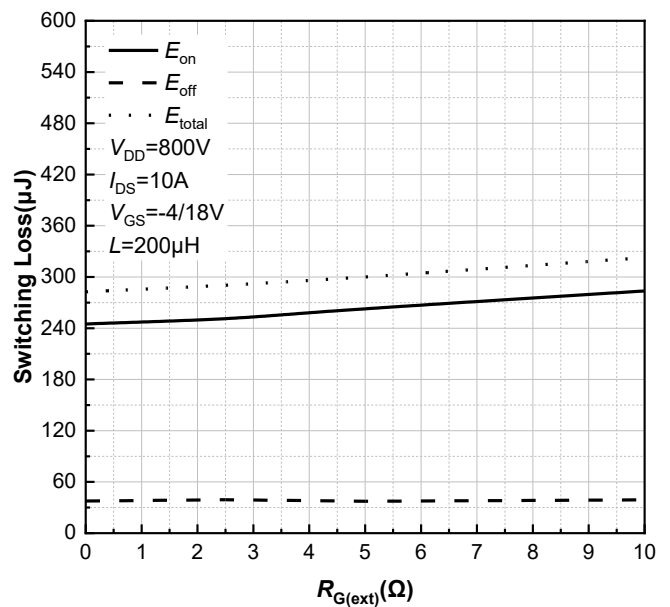


Figure 24. Clamped Inductive Switching  
Energy vs.  $R_{G(\text{ext})}$   
 $T_j = 175^\circ\text{C}$

RATING AND CHARACTERISTIC CURVES

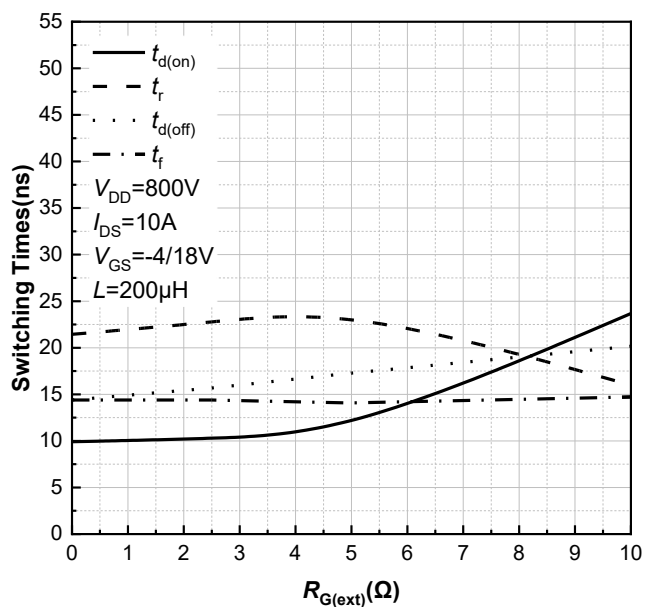


Figure 25. **Switching Times vs.  $R_{G(ext)}$**   
 $T_J = 25^{\circ}\text{C}$

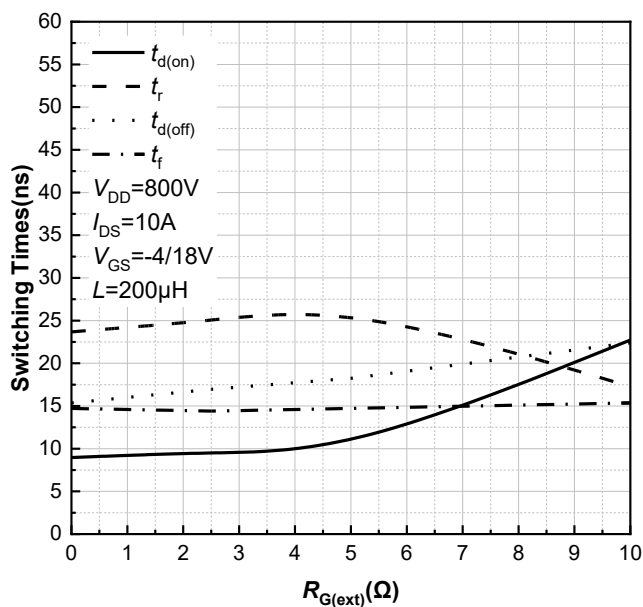


Figure 26. **Switching Times vs.  $R_{G(ext)}$**   
 $T_J = 175^{\circ}\text{C}$

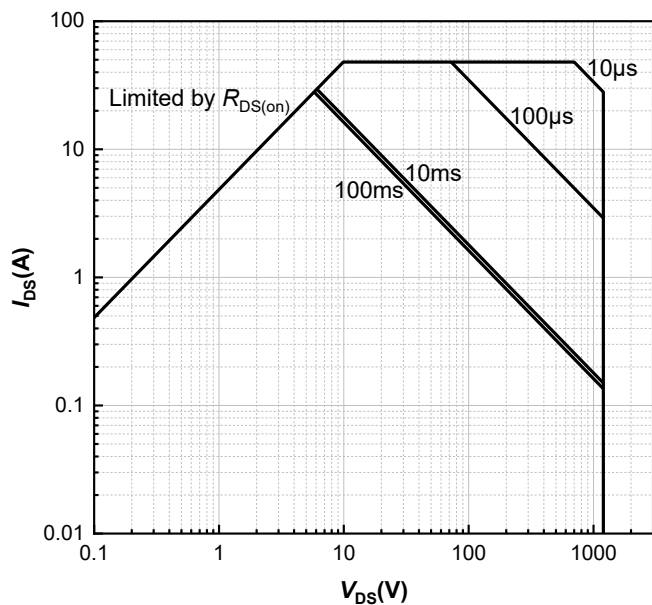
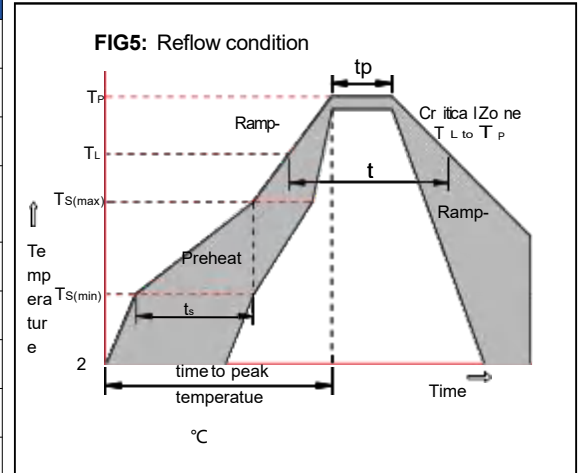


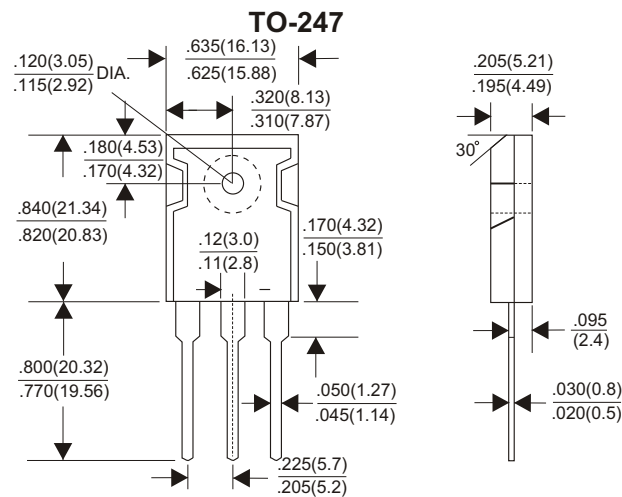
Figure 27. **Safe Operating Area**

## Soldering parameters

| Reflow Condition                                        |                                   | Pb-Free assembly<br>(see as below) |
|---------------------------------------------------------|-----------------------------------|------------------------------------|
| Pre Heat                                                | -Temperature Min ( $T_{s(min)}$ ) | +150 °C                            |
|                                                         | -Temperature Max( $T_{s(max)}$ )  | +200 °C                            |
|                                                         | -Time (Min to Max) (ts)           | 60-180 secs.                       |
| Average ramp up rate (Liquid us Temp ( $T_L$ ) to peak) |                                   | 3 °C/sec. Max                      |
| $T_{s(max)}$ to $T_L$ - Ramp-up Rate                    |                                   | 3 °C/sec. Max                      |
| Reflow                                                  | -Temperature( $T_L$ )(Liquid us)  | +217 °C                            |
|                                                         | -Temperature( $t_L$ )             | 60-150 secs.                       |
| Peak Temp ( $T_P$ )                                     |                                   | +260(+0/-5) °C                     |
| Time within 5 °C of actual Peak Temp ( $t_p$ )          |                                   | 30 secs. Max                       |
| Ramp-down Rate                                          |                                   | 6 °C/sec. Max                      |
| Time 25 °C to Peak Temp ( $T_P$ )                       |                                   | 8 min. Max                         |
| Do not exceed                                           |                                   | +260 °C                            |



## Package Dimensions & Suggested Pad Layout



Dimensions in inches and (millimeters)