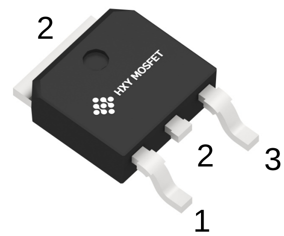
# SPD04N60C3BTMA1

SiC Power MOSFET N-Channel Enhancement Mode

## 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



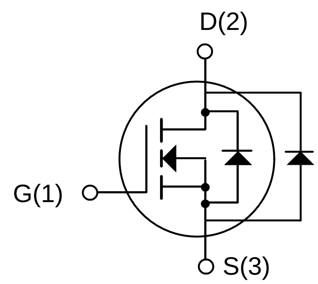

TO-252-2L

## Benefits

- Reduce switching losses
- Increased system Switching Frequency
- Increased power density
- Reduction of heat sink reguirements

## Applications

- Switch mode power supplies
- Fast Charger
- High Voltage DC/DC Converters




| Ordering Part Number | Package | Brand |
|---|---|---|
| SPD04N60C3BTMA1 | TO-252-2L | HXY MOSFET |

## Maximum Ratings ($T_c$ = 25 ˚C unless otherwise specified)

| Symbol | Parameter | Test conditions | Value | Unit | Note |
|---|---|---|---|---|---|
| $V_{DSmax}$ | Drain-Source Voltage | $V_{GS}$ = 0V, $I_D$ = 100μA | 900 | V | |
| $V_{GS}$ | Gate-Source voltage (transient) | $t_p \leqslant$500ns, duty cycle $\leqslant$1% | -8/+20 | V | |
| $V_{GSop}$ | Recommend Gate-Source Voltage | Static | -4/+18 | V | |
| $EAS$ | Single pulse avalanche energy | $V_{DS}$=900V, $V_{DD}$=50V, $V_{GS}$=15V, L=1mH, $T_C$=25°C | 25 | mJ | |
| $I_D$ | Continuous Drain current | $V_{GS}$ = 15V, $T_C$ = 25°C | 11 | A | Fig. 14 |
| | | $V_{GS}$ = 15V, $T_C$ = 100°C | 7.7 | | |
| $I_{D,pulse}$ | Pulsed Drain Current | Pulse with $t_p$ limited by $T_{jmax}$ | 18 | A | |
| $P_D$ | Power Dissipation | $T_C$ = 25°C, $Tj$ = 175°C | 32 | W | Fig. 16 |
| $T_j$ | Operating junction temperature | | -55~175 | °C | |
| $T_{stg}$ | Storage temperature | | -55~175 | °C | |

## Thermal Characteristics

| Symbol | Parameter | Value | | | Unit | Note |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| $R_{th(jc)}$ | Thermal resistance from Junction to Case | | 4.76 | | K/W | Fig. 15 |
| $R_{th(ja)}$ | Thermal resistance from Junction to Ambient | | 40 | | K/W | |

## Electrical Characteristics (T$_C$ = 25˚C unless other wise specified)

### Static Characteristics

| Symbol | Parameter | Test conditions | Value | | | Unit | Note |
|---|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | | |
| $V_{(BR)DSS}$ | Drain-Source Breakdown voltage | $V_{GS}$ = 0V, $I_D$ = 100μA | 900 | | | V | |
| $V_{GS(th)}$ | Gate Threshold voltage | $V_{GS}$ = $V_{DS,}$ $I_D$ =0.35mA | | 3.0 | | V | Fig. 9 |
| | | $V_{GS}$ = $V_{DS,}$ $I_D$ =0.35mA, $T_j$=175°C | | 1.8 | | | |
| $I_{GSS}$ | Gate-Source Leakage current | $V_{GS}$ = 15V, $V_{DS}$ = 0V | | | 250 | nA | |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ =900V, $V_{GS}$ = 0V, $T_j$ = 25°C | | 5 | 50 | μA | |
| $R_{DS(on)}$ | Drain-Source On-state Resistance | $V_{GS}$ = 15V, $I_D$ =2A<br>$V_{GS}$ = 18V, $I_D$ =2A | | 950<br>712 | 1280 | mΩ | Fig. 3, 4 , 5 |
| | | $V_{GS}$ = 15V, $I_D$ =2A, $T_j$ = 175°C<br>$V_{GS}$ = 18V, $I_D$ =2A, $T_j$ = 175°C | | 952<br>853 | | | |
| $g_{fs}$ | Transconductance | $V_{DS}$ = 15V, $I_D$ =2A | | 1.15 | | S | Fig. 6 |
| | | $V_{DS}$ = 15V, $I_D$ =2A, $T_j$ = 175°C | | 1.1 | | | |

## Gate Charge Characteristics

| Symbol | Parameter | Test conditions | Value | | | Unit | Note |
|---|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | | |
| $Q_{GS}$ | Gate to Source Charge | $V_{DS}$ = 400V, $I_D$ =2A, $V_{GS}$ =-4V/15V | | 0.6 | | nC | Fig. 10 |
| $Q_{GD}$ | Gate to Drain Charge | | | 4.1 | | | |
| $Q_G$ | Total Gate Charge | | | 5 | | | |

## AC Characteristics

| Symbol | Parameter | Test conditions | Value | | | Unit | Note |
|---|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | | |
| $C_{iss}$ | Input Capacitance | $V_{GS}$ = 0V, $V_{DS}$ = 600V, f =1 MHz, $V_{AC}$ = 25mV | | 66 | | pF | Fig. 13 |
| $C_{oss}$ | Output Capacitance | | | 14 | | pF | |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 1.9 | | pF | |
| $R_{G(int)}$ | Internal Gate Resistance | f=1 MHz, $V_{AC}$ = 25mV | | 10 | | Ω | |

## Reverse Diode Characteristics

| Symbol | Parameter | Test conditions | Value | | | Unit | Note |
|---|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | | |
| $V_{SD}$ | Diode Forward Voltage | $V_{GS}$ = -4V, $I_{SD}$ = 1A | | 4.9 | | V | Fig. 7,8 |
| | | $V_{GS}$ = -4V, $I_{SD}$ = 1A , $T_j$ = 175°C | | 4.4 | | | |
| $I_S$ | Continuous Diode Forward Current | $V_{GS}$ = -4V, $T_C$ = 25°C | | 8.3 | | A | |
| $I_{S, pulse}$ | Diode pulse Current | $V_{GS}$ = -4V, pulse width $t_p$ limited by $T_{jmax}$ | | 18 | | A | |

## Typical Performance

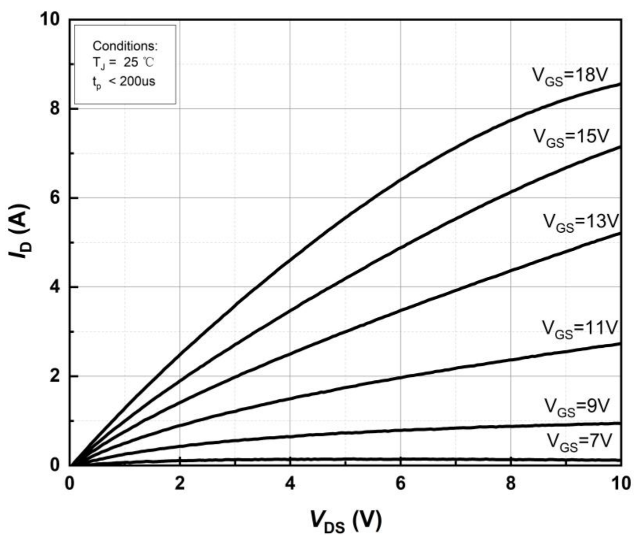



**Figure 1. Output characteristics at Tj=25°C**

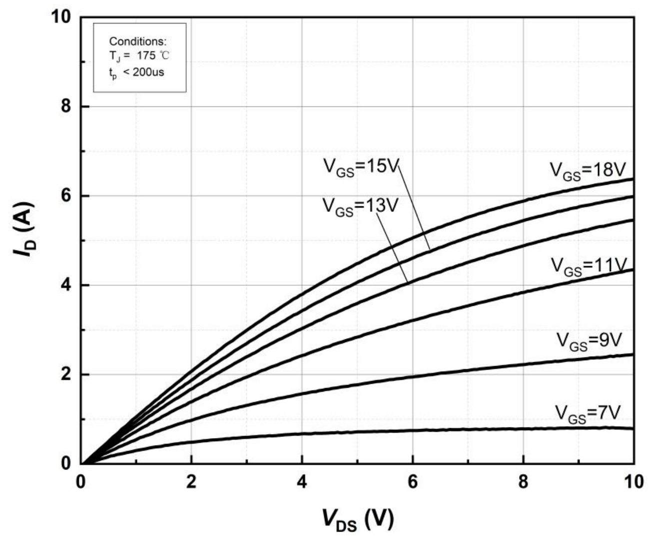



**Figure 2. Output characteristics at Tj=175°C**

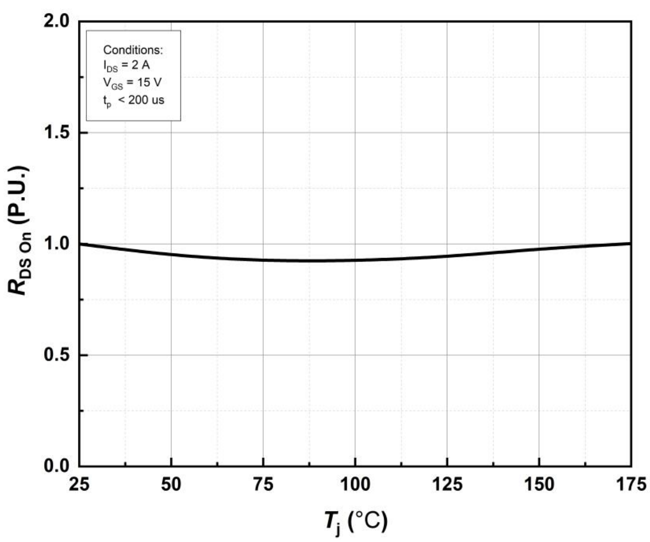



**Figure 3. Normalized On-Resistance vs. Temperature**

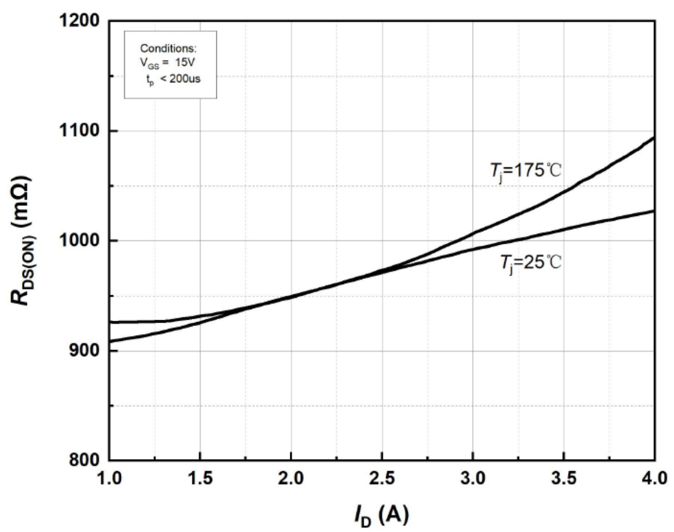



**Figure 4. On-Resistance vs. Drain current for Various Temperature**

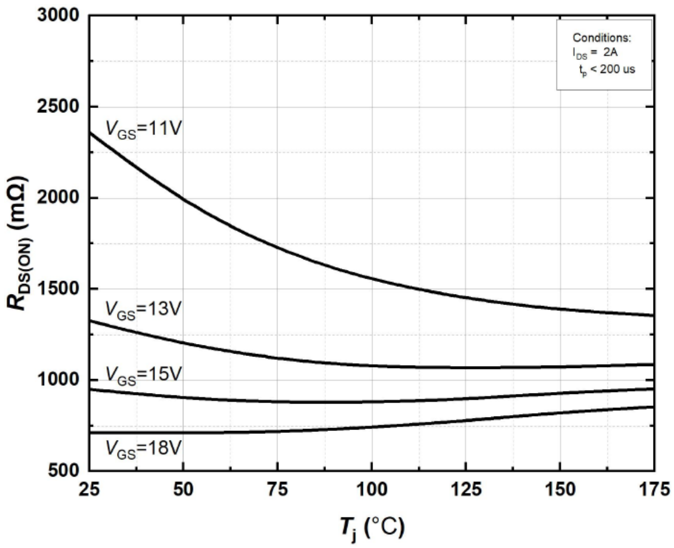



Figure 5. On-Resistance vs. Temperature for Various Gate Voltage

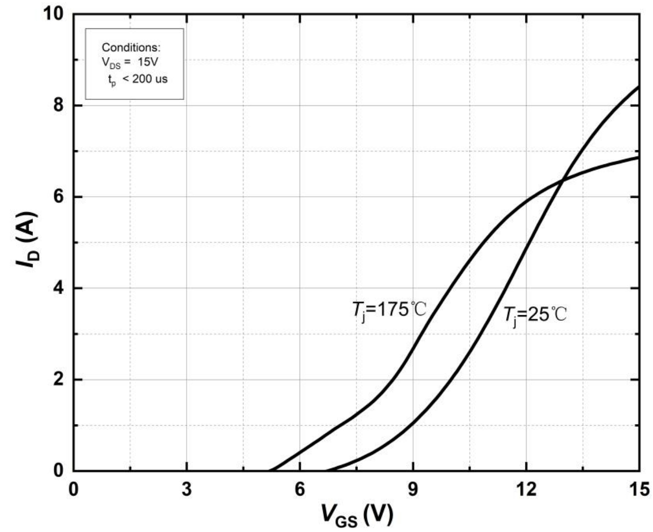



Figure 6. Transfer Characteristics for Various Junction Temperatures

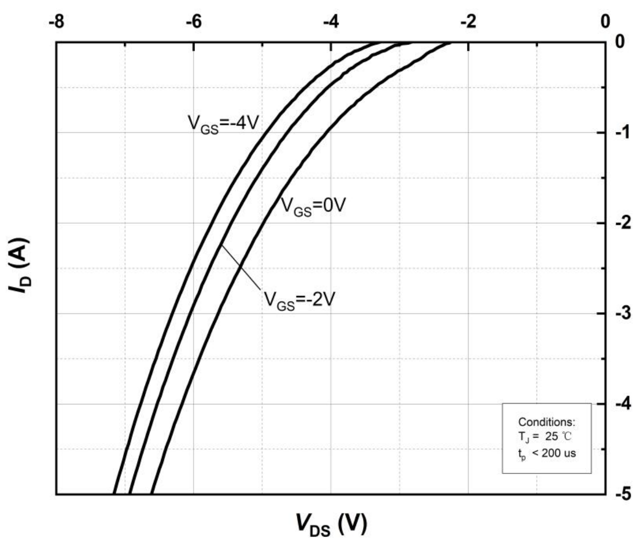



Figure 7. Body Diode Characteristics at Tj=25°C

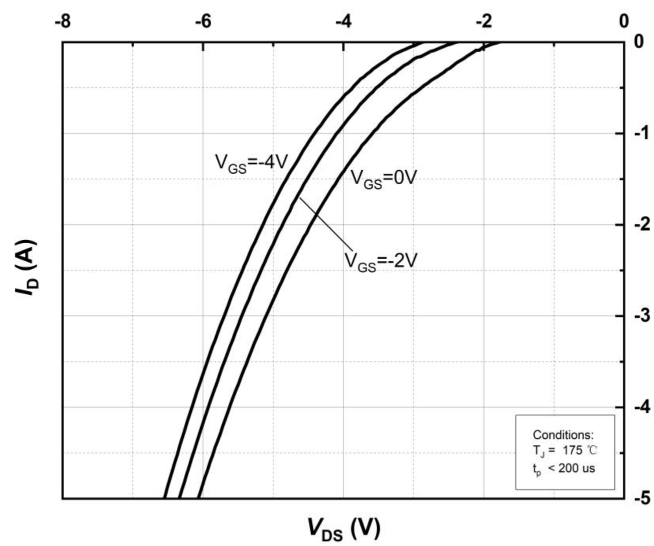



Figure 8. Body Diode Characteristics at Tj=175°C

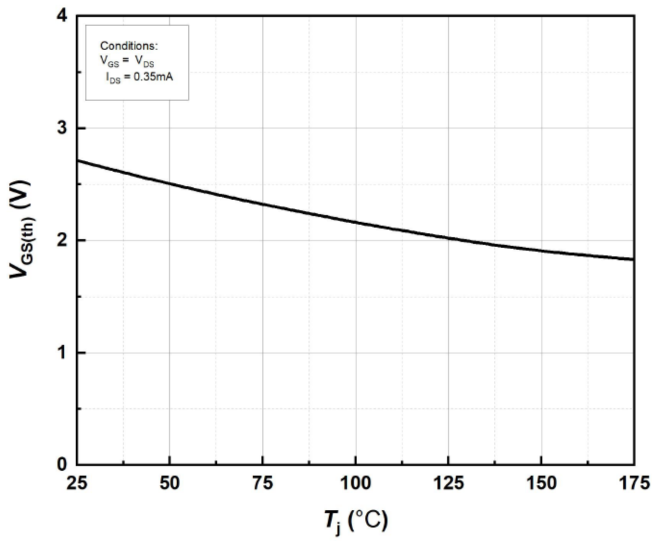



Figure 9. Threshold Voltage vs. Temperature

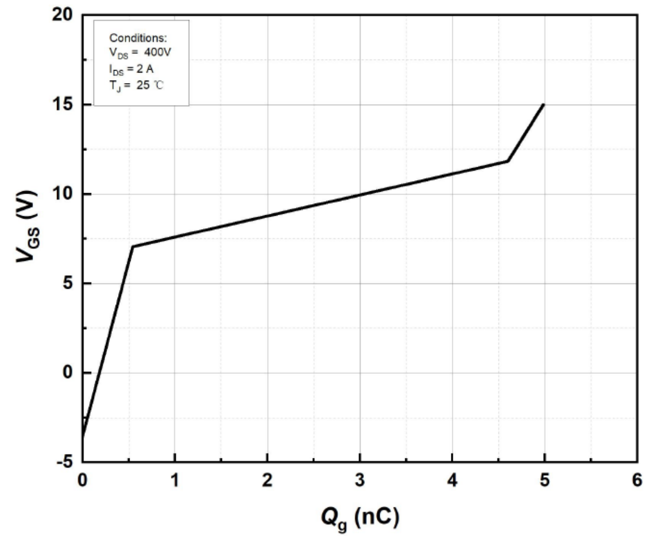



Figure 10 Gate Charge Characteristics

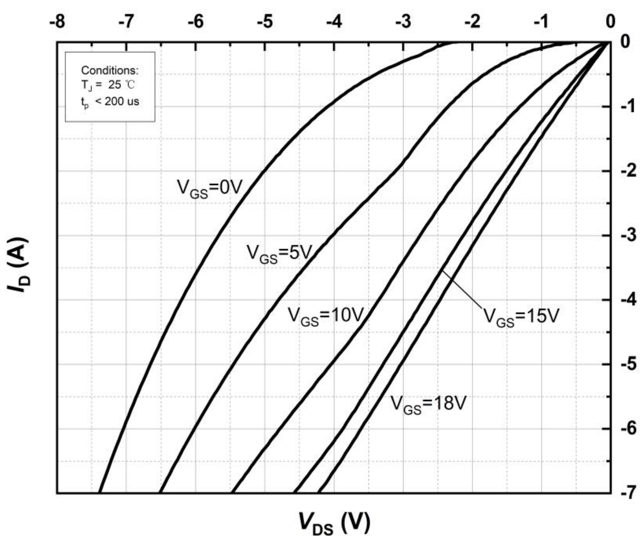



Figure 11. 3rd Quadrant Characteristic at Tj=25°C

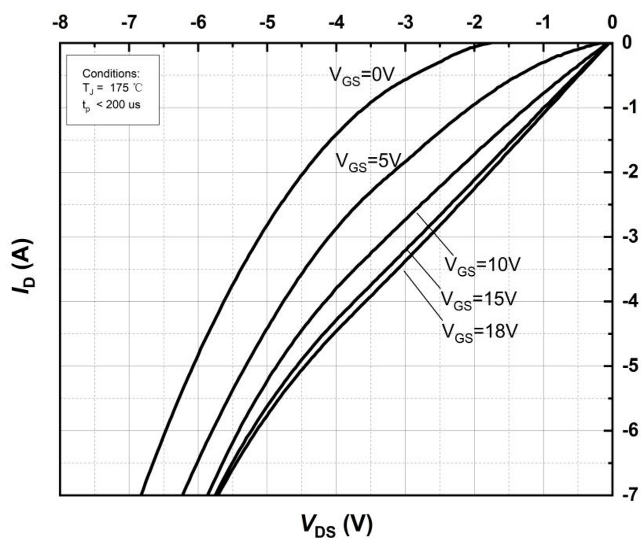



Figure 12. 3rd Quadrant Characteristic at Tj=175°C

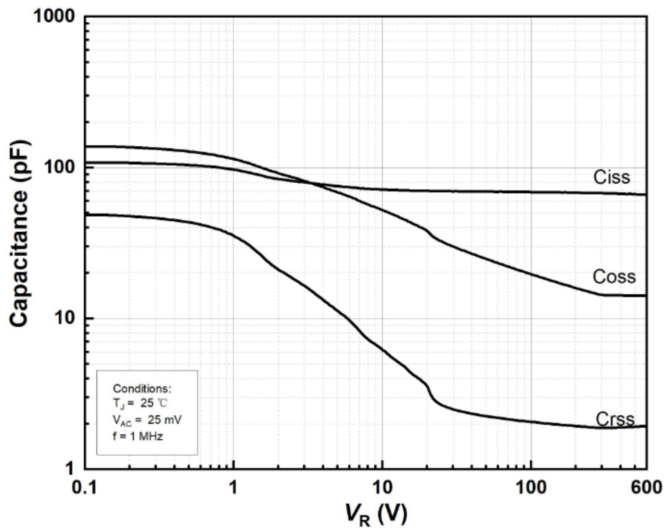



**Figure 13. Capacitances vs. Drain-Source Voltage (0 – 600V)**

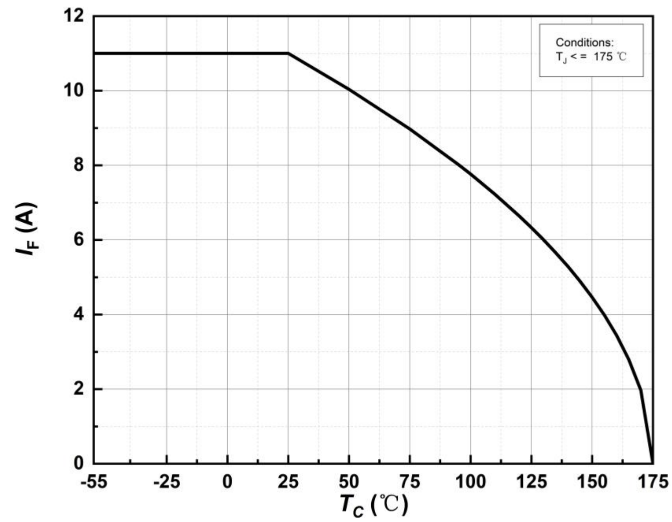



**Figure 14. Continuous Drain Current Derating vs Case Temperature**

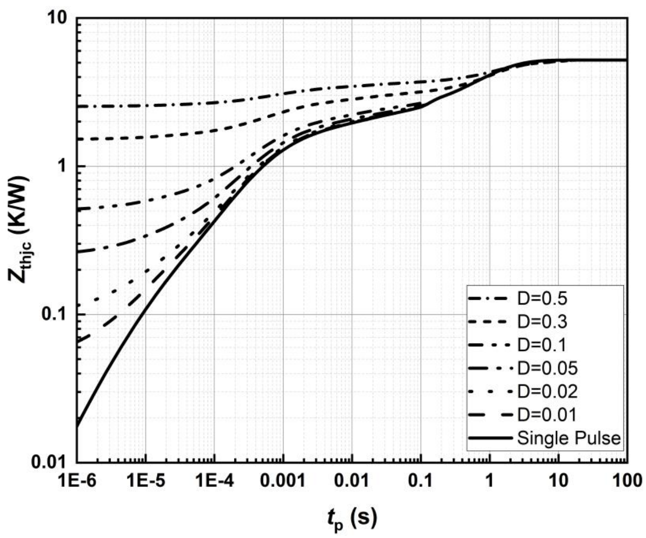



**Figure 15.Transient Thermal Impedance (Junction – Case)**

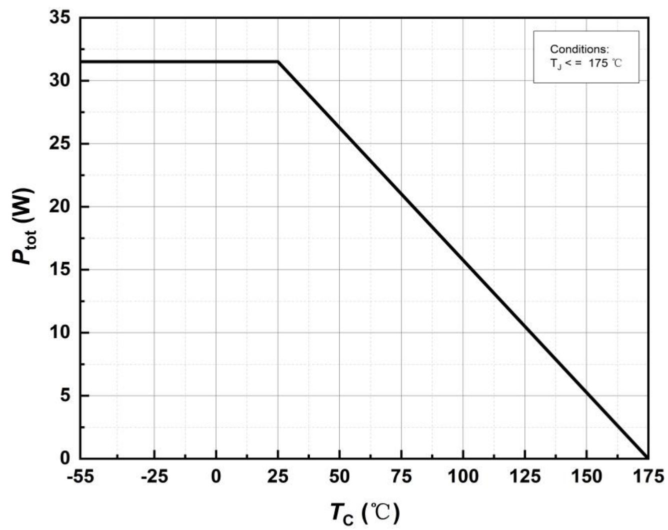



**Figure 16. Maximum Power Dissipation Derating vs. Case Temperature**

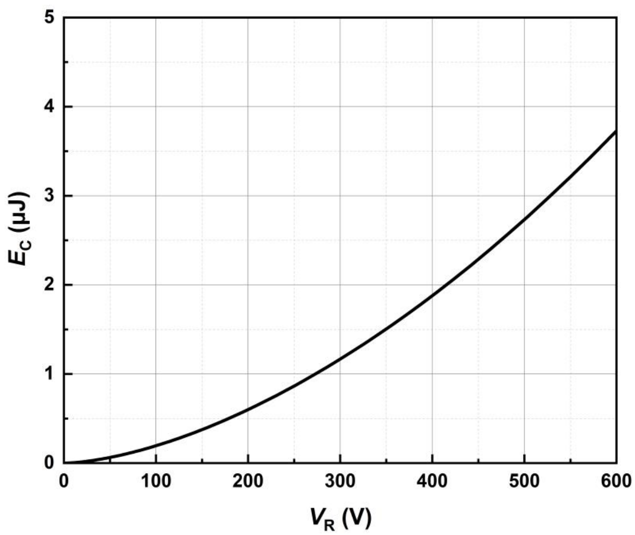



**Figure 17. Output Capacitor Stored Energy**

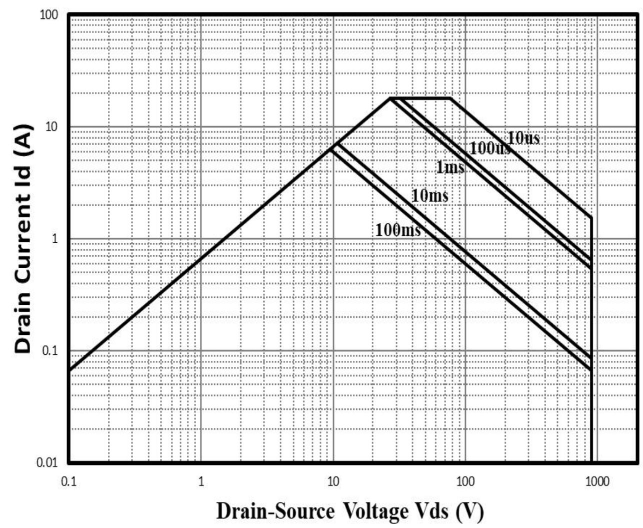
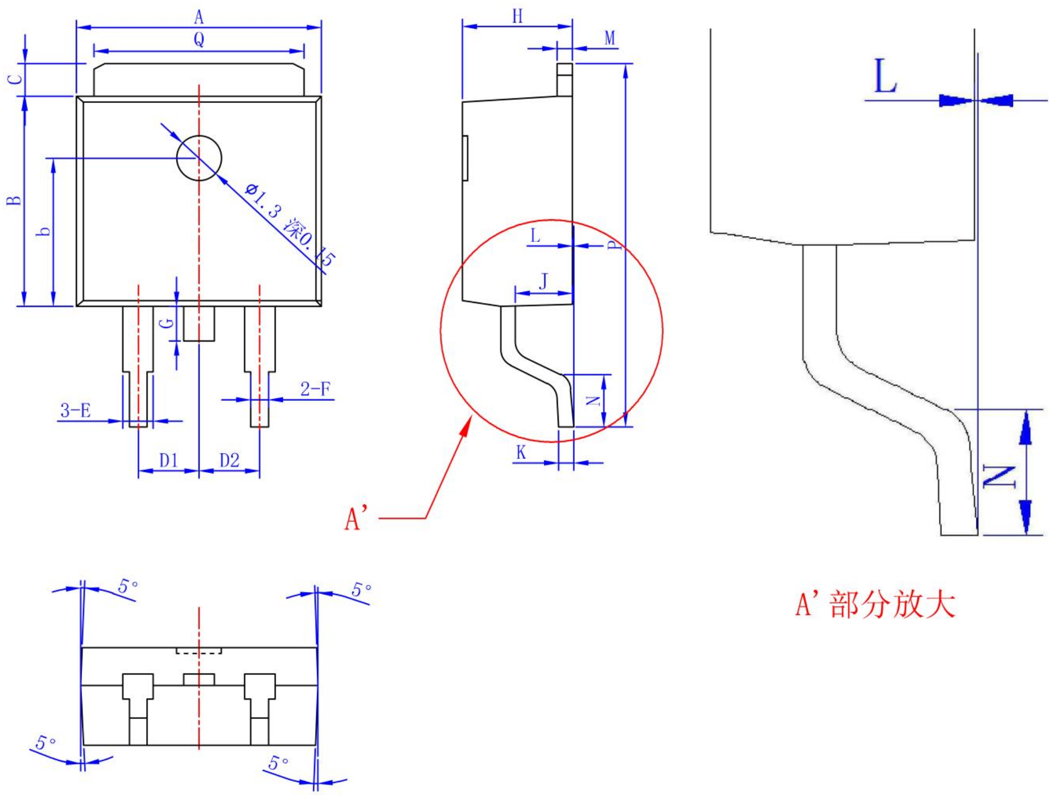



**Figure 18. Safe Operating Area**

## Package Dimensions

Package TO-252-2L




| SYMBOL | MM | | |
|---|---|---|---|
| | MIN | NOM | MAX |
| *A | 6.30 | 6.55 | 6.90 |
| *B | 5.90 | 6.10 | 6.30 |
| b | 4.10 | 4.30 | 4.50 |
| C | 0.90 | 1.00 | 1.10 |
| *D1 | | 2.29BSC | |
| *D2 | | 2.29BSC | |
| *E | 0.61 | 0.76 | 0.91 |
| *F | 0.50 | 0.60 | 0.70 |
| G | 0.60 | 0.80 | 1.00 |
| *H | 2.10 | 2.30 | 2.50 |
| *J | 0.90 | 1.00 | 1.10 |
| *K | 0.40 | 0.50 | 0.60 |
| *L | 0.00 | 0.05 | 0.127 |
| *M | 0.45 | 0.50 | 0.55 |
| *N | 1.39 | | 1.77 |
| *P | 9.60 | 9.90 | 10.30 |
| Q | 5.10 | 5.30 | 5.50 |
| 带*为必须检验尺寸 | | | |

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