

## N-Channel Enhancement Mode Power MOSFET

## Description

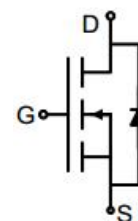
The 5N20A uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge. It can be used in a wide variety of applications.

## General Features

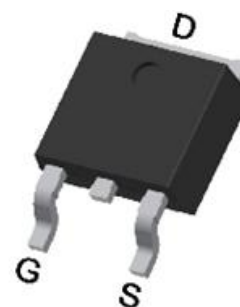
- $V_{DS}$  200V
- $I_D$  (at  $V_{GS} = 10V$ ) 5A
- $R_{DS(ON)}$  (at  $V_{GS} = 10V$ ) < 580mΩ
- Fast switching
- 100% Avalanche Tested
- Improved dv/dt capability
- RoHS Compliant

## Application

- DC Motor Control and Class D Amplifier
- Uninterruptible Power Supply (UPS)
- Automotive



Schematic diagram



TO-252

## Ordering Information

| Device | Package | Marking | Packaging    |
|--------|---------|---------|--------------|
| 5N20A  | TO-252  | 5N20A   | 2500pcs/Reel |

Absolute Maximum Ratings  $T_C = 25^\circ\text{C}$ , unless otherwise noted

| Parameter                                        | Symbol         | Value      | Unit             |
|--------------------------------------------------|----------------|------------|------------------|
| Drain-Source Voltage                             | $V_{DS}$       | 200        | V                |
| Continuous Drain Current                         | $I_D$          | 5          | A                |
| Pulsed Drain Current (note1)                     | $I_{DM}$       | 20         | A                |
| Gate-Source Voltage                              | $V_{GS}$       | $\pm 20$   | V                |
| Power Dissipation                                | $P_D$          | 78         | W                |
| Single pulse avalanche energy (note2)            | $E_{AS}$       | 25         | mJ               |
| Operating Junction and Storage Temperature Range | $T_J, T_{stg}$ | -55 To 150 | $^\circ\text{C}$ |

## Thermal Resistance

| Parameter                               | Symbol     | Value | Unit               |
|-----------------------------------------|------------|-------|--------------------|
| Thermal Resistance, Junction-to-Ambient | $R_{thJA}$ | 50    | $^\circ\text{C/W}$ |
| Maximum Junction-to-Case                | $R_{thJC}$ | 1.6   | $^\circ\text{C/W}$ |

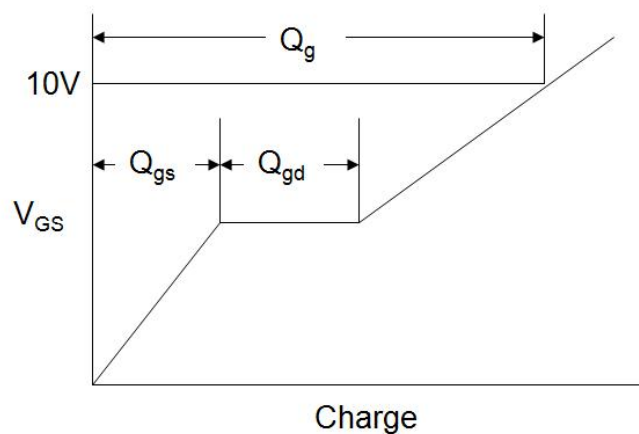
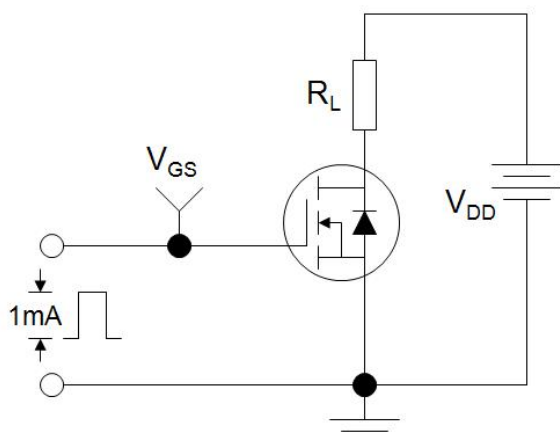
**Specifications**  $T_J = 25^\circ\text{C}$ , unless otherwise noted

| Parameter                               | Symbol               | Test Conditions                                                          | Value |      |      | Unit |
|-----------------------------------------|----------------------|--------------------------------------------------------------------------|-------|------|------|------|
|                                         |                      |                                                                          | Min.  | Typ. | Max. |      |
| Static Parameters                       |                      |                                                                          |       |      |      |      |
| Drain-Source Breakdown Voltage          | V <sub>(BR)DSS</sub> | V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA                             | 200   | --   | --   | V    |
| Zero Gate Voltage Drain Current         | I <sub>DSS</sub>     | V <sub>DS</sub> = 200V, V <sub>GS</sub> = 0V                             | --    | --   | 1    | μA   |
| Gate-Source Leakage                     | I <sub>GSS</sub>     | V <sub>GS</sub> = ±20V                                                   | --    | --   | ±100 | nA   |
| Gate-Source Threshold Voltage           | V <sub>GS(th)</sub>  | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA               | 1.0   | 2.0  | 3.0  | V    |
| Drain-Source On-Resistance              | R <sub>DS(on)</sub>  | V <sub>GS</sub> = 10V, I <sub>D</sub> = 1A                               | --    | 420  | 580  | mΩ   |
| Forward Transconductance                | g <sub>FS</sub>      | V <sub>GS</sub> = 5V, I <sub>D</sub> = 1A                                | --    | 8    | --   | S    |
| Dynamic Parameters                      |                      |                                                                          |       |      |      |      |
| Input Capacitance                       | C <sub>iss</sub>     | V <sub>GS</sub> = 0V,<br>V <sub>DS</sub> = 100V,<br>f = 1.0MHz           | --    | 247  | --   | pF   |
| Output Capacitance                      | C <sub>oss</sub>     |                                                                          | --    | 21   | --   |      |
| Reverse Transfer Capacitance            | C <sub>rss</sub>     |                                                                          | --    | 7    | --   |      |
| Total Gate Charge                       | Q <sub>g</sub>       | V <sub>DD</sub> = 100V,<br>I <sub>D</sub> = 1A,<br>V <sub>GS</sub> = 10V | --    | 11   | --   | nC   |
| Gate-Source Charge                      | Q <sub>gs</sub>      |                                                                          | --    | 2    | --   |      |
| Gate-Drain Charge                       | Q <sub>gd</sub>      |                                                                          | --    | 3    | --   |      |
| Turn-on Delay Time                      | t <sub>d(on)</sub>   | V <sub>DD</sub> = 100V,<br>I <sub>D</sub> = 1A,<br>R <sub>G</sub> = 10Ω  | --    | 7    | --   | ns   |
| Turn-on Rise Time                       | t <sub>r</sub>       |                                                                          | --    | 11   | --   |      |
| Turn-off Delay Time                     | t <sub>d(off)</sub>  |                                                                          | --    | 18   | --   |      |
| Turn-off Fall Time                      | t <sub>f</sub>       |                                                                          | --    | 12   | --   |      |
| Drain-Source Body Diode Characteristics |                      |                                                                          |       |      |      |      |
| Continuous Body Diode Current           | I <sub>S</sub>       | T <sub>C</sub> = 25°C                                                    | --    | --   | 5    | A    |
| Body Diode Voltage                      | V <sub>SD</sub>      | T <sub>J</sub> = 25°C, I <sub>SD</sub> = 1A, V <sub>GS</sub> = 0V        | --    | --   | 1.2  | V    |
| Reverse Recovery Charge                 | Q <sub>rr</sub>      | I <sub>F</sub> = 1A, V <sub>GS</sub> = 0V<br>di/dt=100A/us               | --    | 357  | --   | nC   |
| Reverse Recovery Time                   | T <sub>rr</sub>      |                                                                          | --    | 126  | --   | ns   |

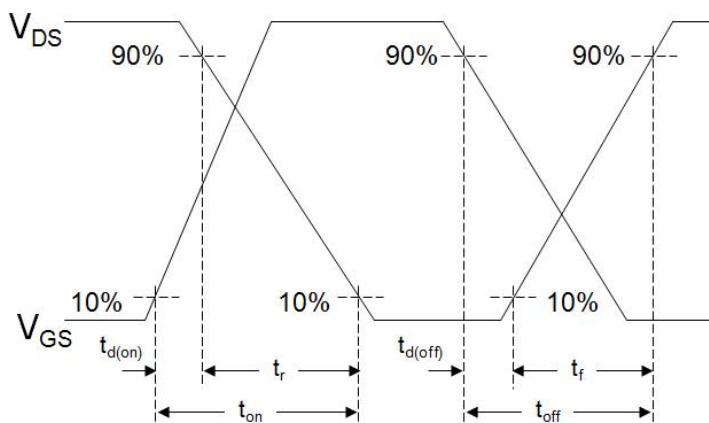
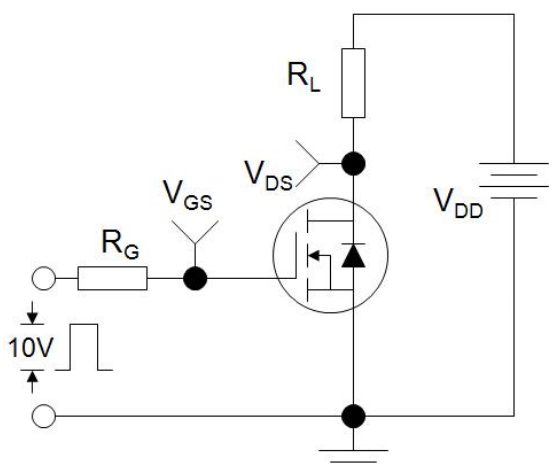
**Notes**

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. EAS condition :  $T_J = 25^\circ\text{C}$ ,  $V_{DD} = 50V$ ,  $V_{GS} = 10V$ ,  $L = 0.5mH$ ,  $R_G = 25\Omega$
3. Identical low side and high side switch with identical  $R_G$

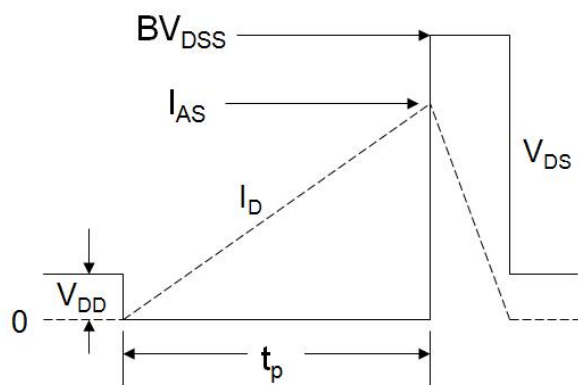
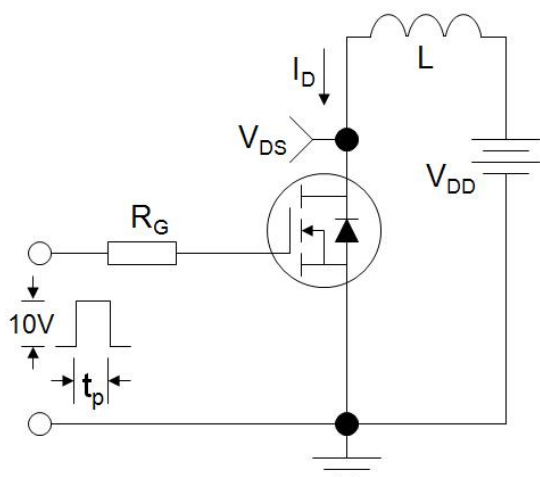
### Gate Charge Test Circuit



### Switch Time Test Circuit

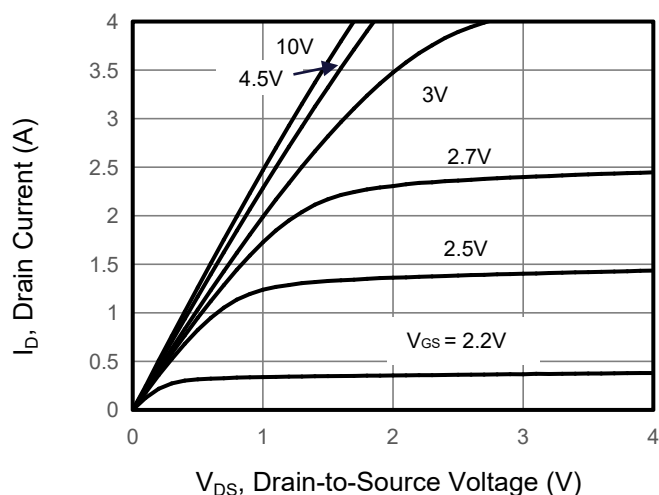


### EAS Test Circuit

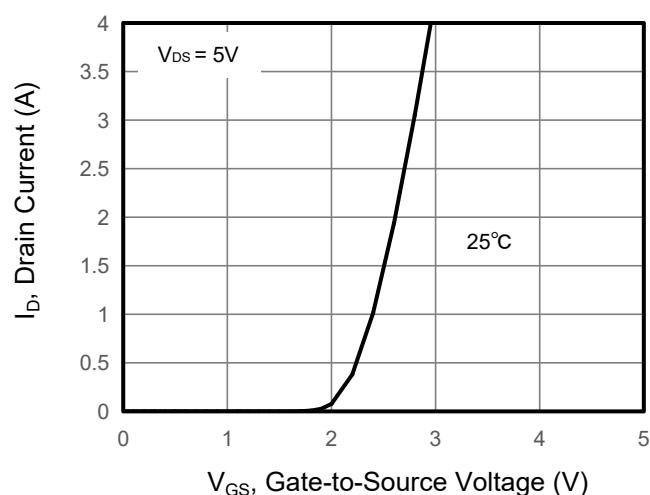


**Typical Characteristics**  $T_J = 25^\circ\text{C}$ , unless otherwise noted

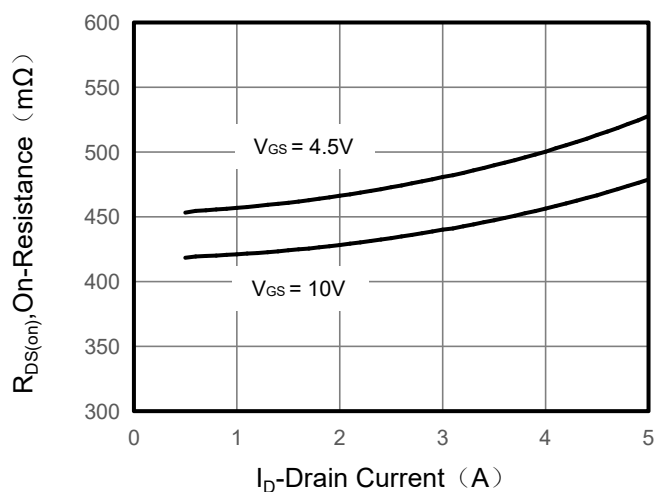
**Figure 1. Output Characteristics**



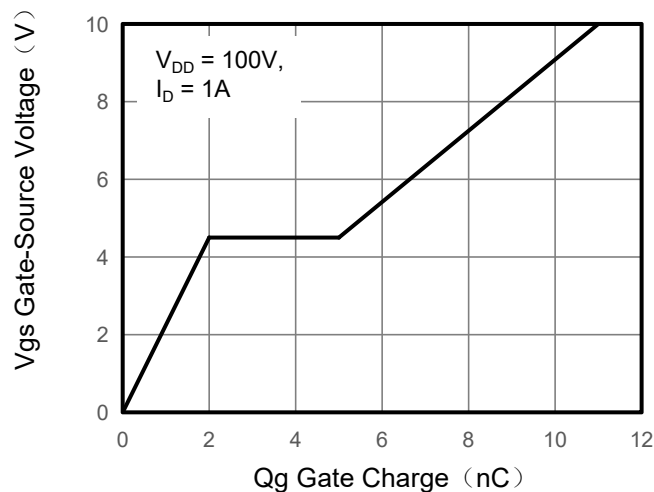
**Figure 2. Transfer Characteristics**



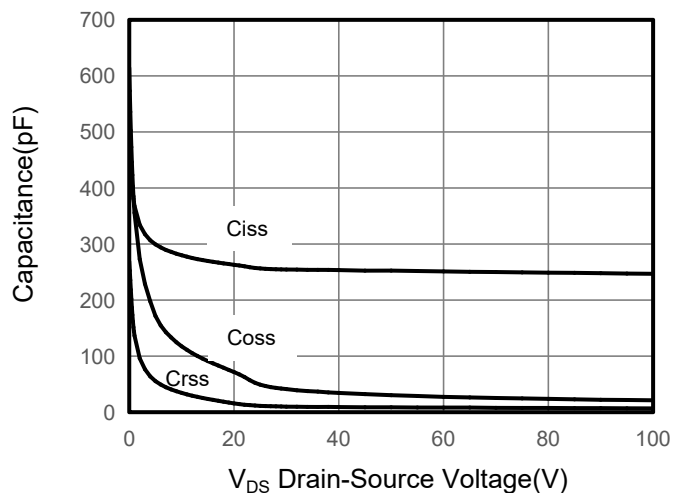
**Figure 3. Drain Source On Resistance**



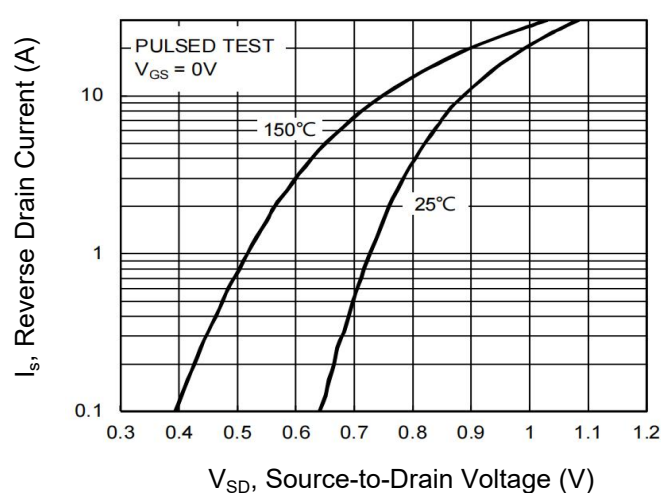
**Figure 4. Gate Charge**



**Figure 5. Capacitance**

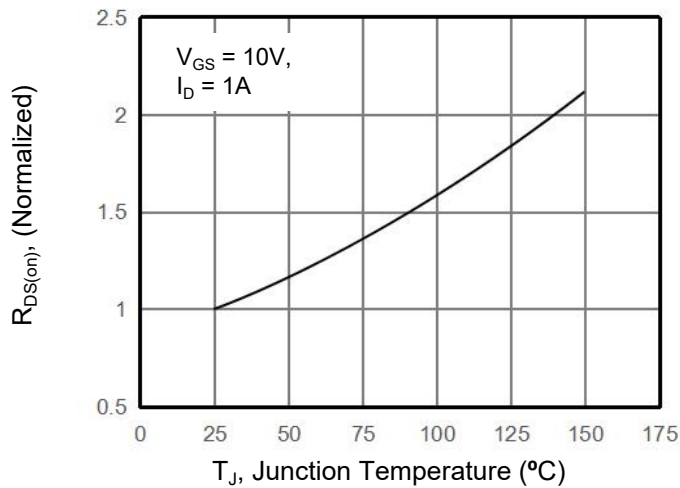


**Figure 6. Source-Drain Diode Forward**

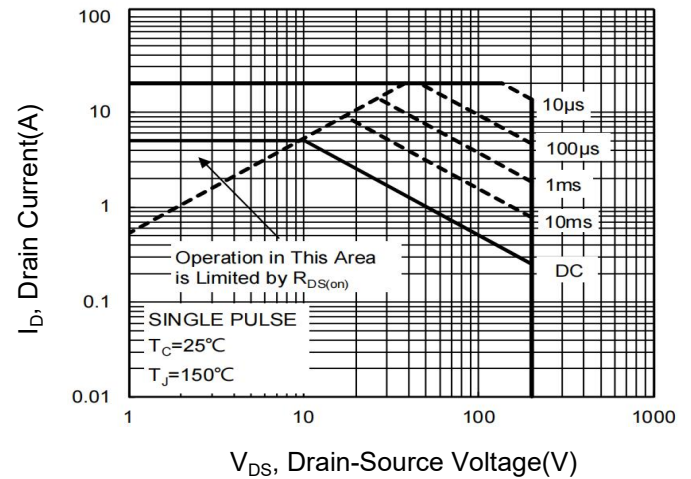


**Typical Characteristics**  $T_J = 25^\circ\text{C}$ , unless otherwise noted

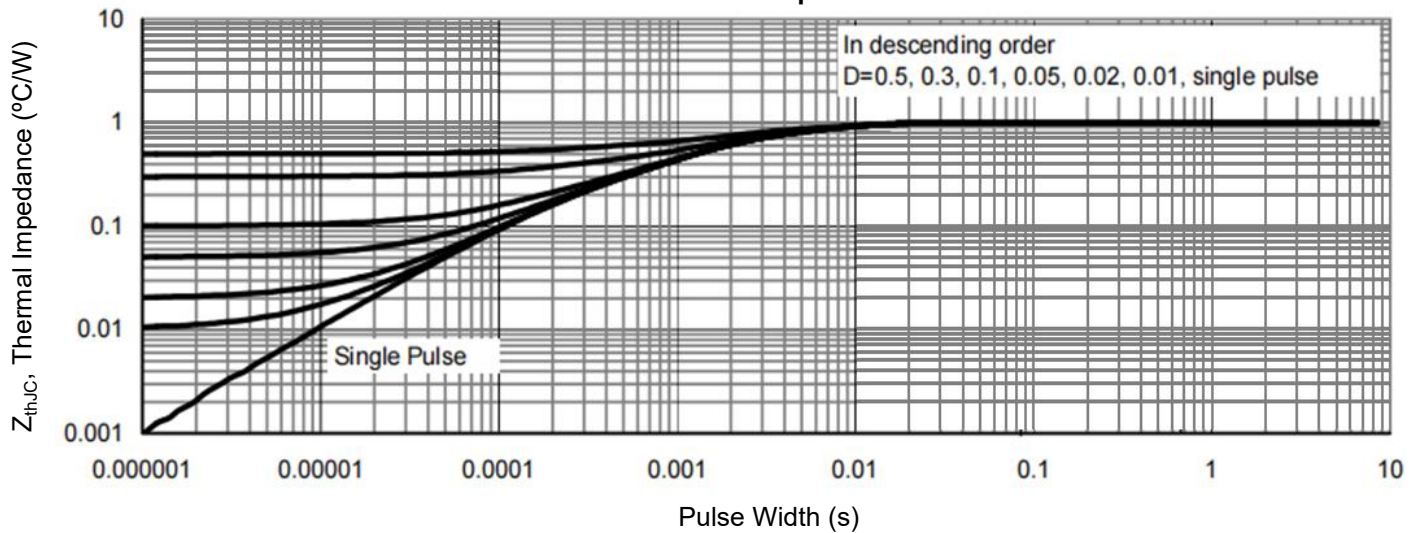
**Figure 7. Drain-Source On-Resistance**



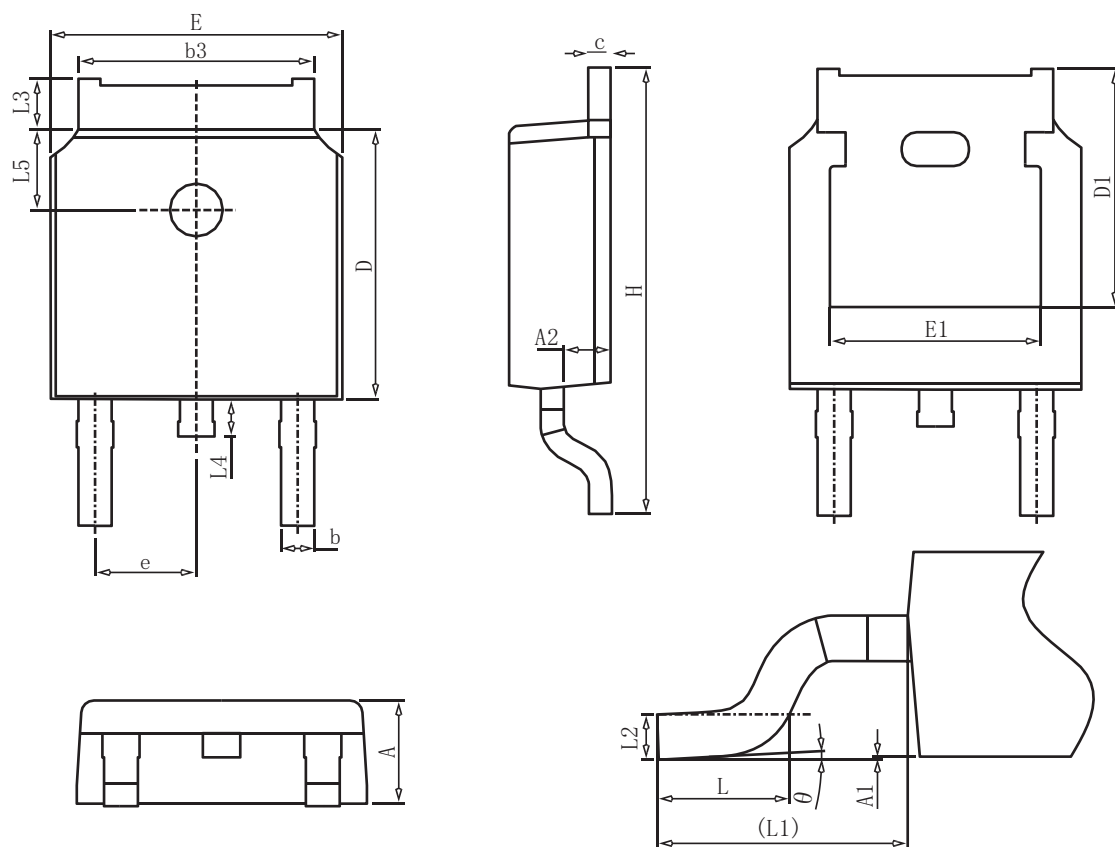
**Figure 8. Safe Operation Area**



**Figure 9. Normalized Maximum Transient Thermal Impedance**



## TO-252 Package Information



## COMMON DIMENSIONS

| SYMBOL   | mm       |       |       |
|----------|----------|-------|-------|
|          | MIN      | NOM   | MAX   |
| A        | 2.20     | 2.30  | 2.40  |
| A1       | 0.00     | -     | 0.20  |
| A2       | 0.97     | 1.07  | 1.17  |
| b        | 0.68     | 0.78  | 0.90  |
| b3       | 5.20     | 5.33  | 5.50  |
| c        | 0.43     | 0.53  | 0.63  |
| D        | 5.98     | 6.10  | 6.22  |
| D1       | 5.30REF  |       |       |
| E        | 6.40     | 6.60  | 6.80  |
| E1       | 4.63     | -     | -     |
| e        | 2.286BSC |       |       |
| H        | 9.40     | 10.10 | 10.50 |
| L        | 1.38     | 1.50  | 1.75  |
| L1       | 2.90REF  |       |       |
| L2       | 0.51BSC  |       |       |
| L3       | 0.88     | -     | 1.28  |
| L4       | 0.50     | -     | 1.00  |
| L5       | 1.65     | 1.80  | 1.95  |
| $\theta$ | 0°       | -     | 8°    |