# N-Channel Enhancement Mode Power MOSFET

## Description

The GT040N04MA uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge. It can be used in a wide variety of applications.

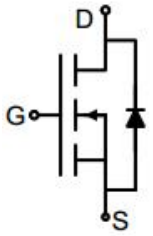
AEC-Q101 Qualified

## General Features

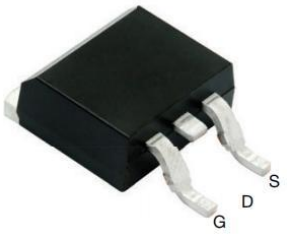
- $V_{DS}$ 40V
- $I_D$ (at $V_{GS}$ = 10V) 120A
- $R_{DS(ON)}$ (at $V_{GS}$ = 10V) < 4mΩ
- $R_{DS(ON)}$ (at $V_{GS}$ = 4.5V) < 5mΩ
- 100% Avalanche Tested
- RoHS Compliant

## Application

- Power switch
- DC/DC converters




Schematic diagram




TO-263

## Ordering Information

| Device | Package | Marking | Packaging |
|---|---|---|---|
| GT040N04MA | TO-263 | GT040N04 | 800pcs/Reel |

## Absolute Maximum Ratings $T_C$ = 25ºC, unless otherwise noted

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Drain-Source Voltage | $V_{DS}$ | 40 | V |
| Continuous Drain Current | $I_D$ | 120 | A |
| Pulsed Drain Current (note1) | $I_{DM}$ | 480 | A |
| Gate-Source Voltage | $V_{GS}$ | ±20 | V |
| Power Dissipation | $P_D$ | 96 | W |
| Single pulse avalanche energy （note2） | $E_{AS}$ | 56 | mJ |
| Operating Junction and Storage Temperature Range | $T_J$, $T_{stg}$ | -55 To 150 | ºC |

## Thermal Resistance

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance, Junction-to-Ambient | $R_{thJA}$ | 62 | ºC/W |
| Maximum Junction-to-Case | $R_{thJC}$ | 1.3 | ºC/W |

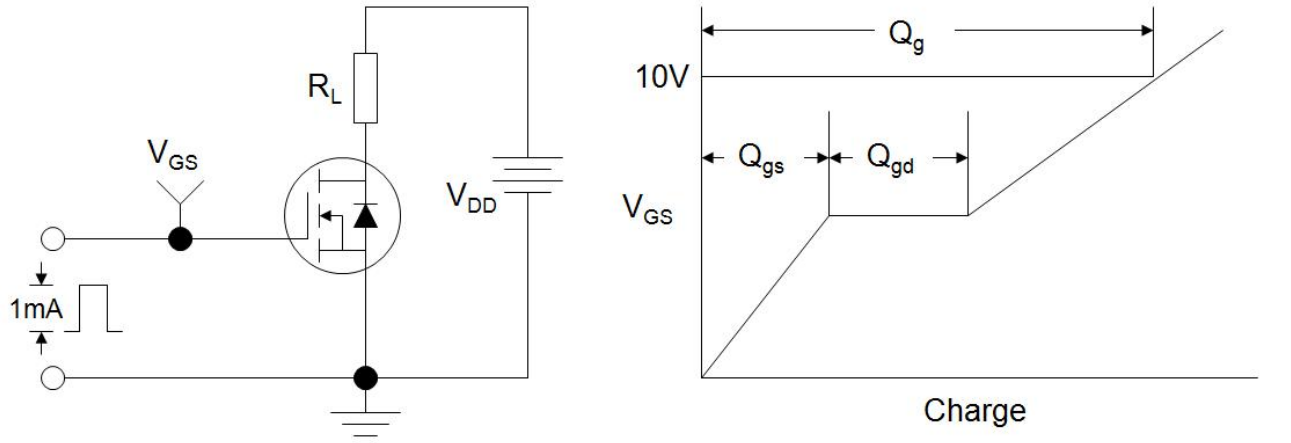
**Specifications** $T_J$ = 25ºC, unless otherwise noted

| Parameter | Symbol | Test Conditions | Value | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| **Static Parameters** | | | | | | |
| Drain-Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS}$ = 0V, $I_D$ = 250μA | 40 | -- | -- | V |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ = 40V, $V_{GS}$ = 0V | -- | -- | 1 | μA |
| Gate-Source Leakage | $I_{GSS}$ | $V_{GS}$ = ±20V | -- | -- | ±100 | nA |
| Gate-Source Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = 250μA | 1.0 | 1.6 | 2.3 | V |
| Drain-Source On-Resistance | $R_{DS(on)}$ | $V_{GS}$ = 10V, $I_D$ = 30A | -- | 3.2 | 4 | mΩ |
| | | $V_{GS}$ = 4.5V, $I_D$ = 20A | -- | 4.1 | 5 | |
| Forward Transconductance | $g_{FS}$ | $V_{GS}$ = 5V, $I_D$ = 30A | -- | 62 | -- | S |
| **Dynamic Parameters** | | | | | | |
| Input Capacitance | $C_{iss}$ | $V_{GS}$ = 0V, $V_{DS}$ = 20V, f = 1.0MHz | -- | 2794 | -- | pF |
| Output Capacitance | $C_{oss}$ | | -- | 727 | -- | |
| Reverse Transfer Capacitance | $C_{rss}$ | | -- | 28 | -- | |
| Total Gate Charge | $Q_g$ | $V_{DD}$ = 20V, $I_D$ = 30A, $V_{GS}$ = 10V | -- | 38 | -- | nC |
| Gate-Source Charge | $Q_{gs}$ | | -- | 9 | -- | |
| Gate-Drain Charge | $Q_{gd}$ | | -- | 5 | -- | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD}$ = 20V, $I_D$ = 30A, $R_G$ = 3Ω | -- | 12 | -- | ns |
| Turn-on Rise Time | $t_r$ | | -- | 5 | -- | |
| Turn-off Delay Time | $t_{d(off)}$ | | -- | 46 | -- | |
| Turn-off Fall Time | $t_f$ | | -- | 8 | -- | |
| **Drain-Source Body Diode Characteristics** | | | | | | |
| Continuous Body Diode Current | $I_S$ | $T_C$ = 25ºC | -- | -- | 120 | A |
| Body Diode Voltage | $V_{SD}$ | $T_J$ = 25ºC, $I_{SD}$ = 30A, $V_{GS}$ = 0V | -- | -- | 1.2 | V |
| Reverse Recovery Charge | Qrr | $I_F$ = 30A, $V_{GS}$ = 0V di/dt=500A/us | -- | 62 | -- | nC |
| Reverse Recovery Time | Trr | | -- | 31 | -- | ns |

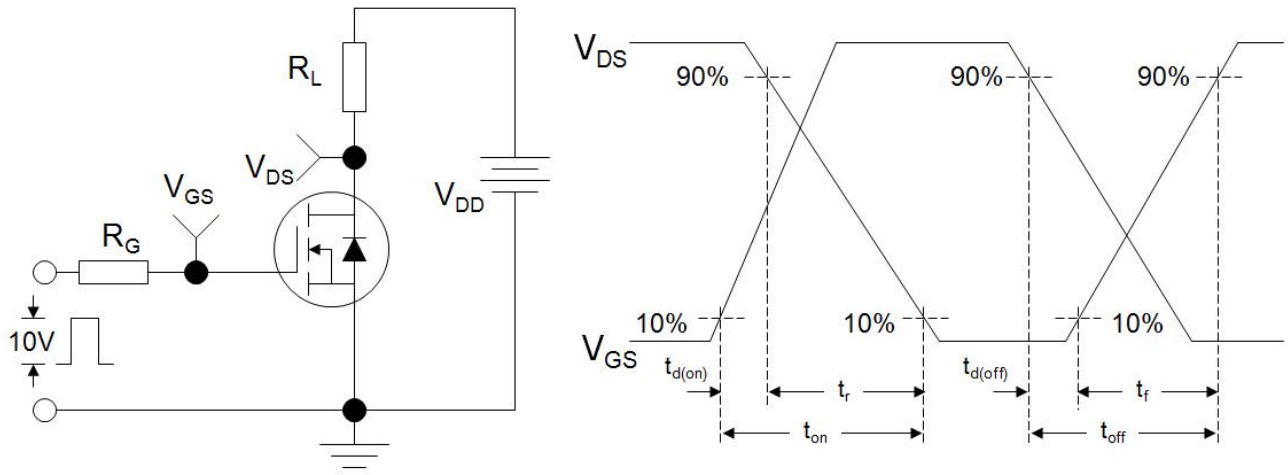
**Notes**

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. EAS condition : Tj=25℃ ,VDD=40V,VGS=10V,L=0.5mH,Rg=25Ω
   The table shows the minimum avalanche energy, which is 1444mJ when the device is tested until failure
3. Identical low side and high side switch with identical $R_G$

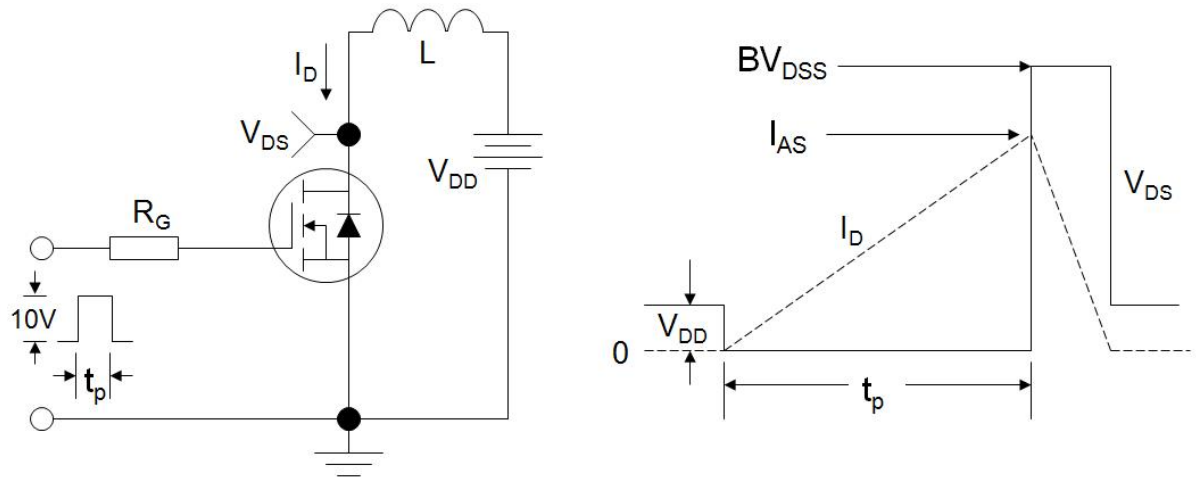
**Gate Charge Test Circuit**




**Switch Time Test Circuit**




**EAS Test Circuit**



## Typical Characteristics $T_J$ = 25ºC, unless otherwise noted

**Figure 1. Output Characteristics**

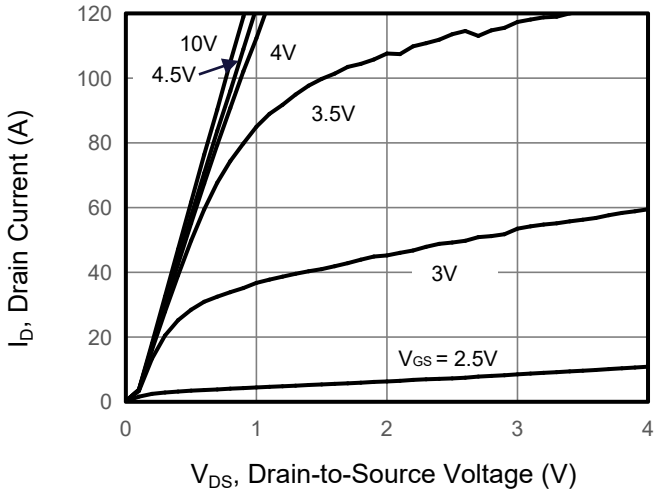



**Figure 2. Transfer Characteristics**

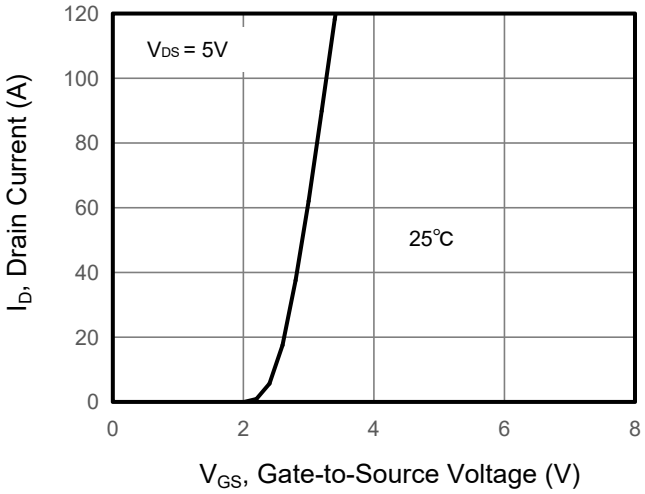



**Figure 3. Drain Source On Resistance**

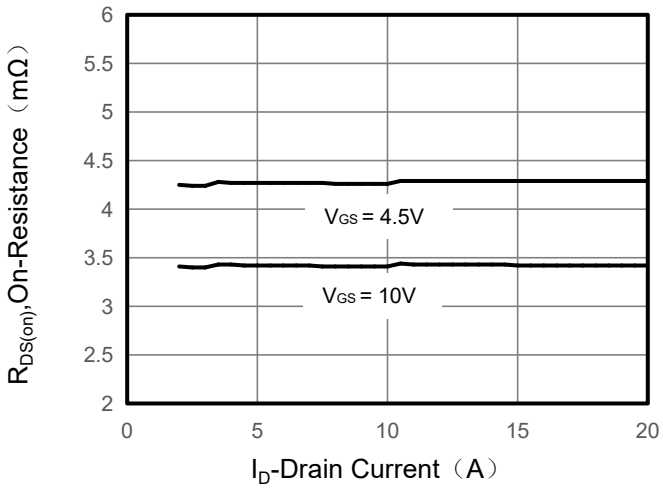



**Figure 4. Gate Charge**

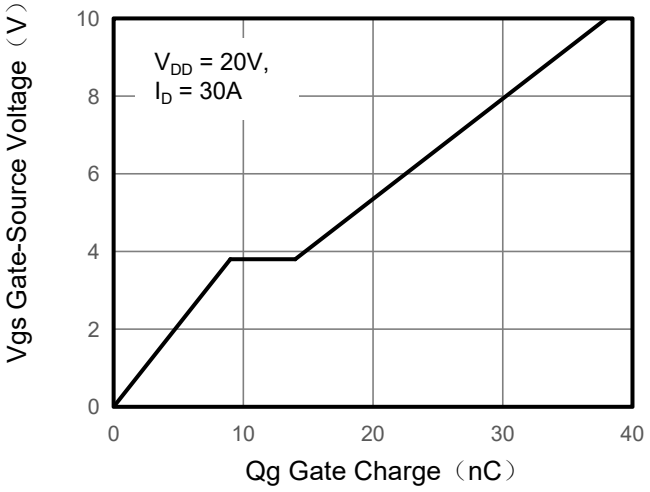



**Figure 5. Capacitance**

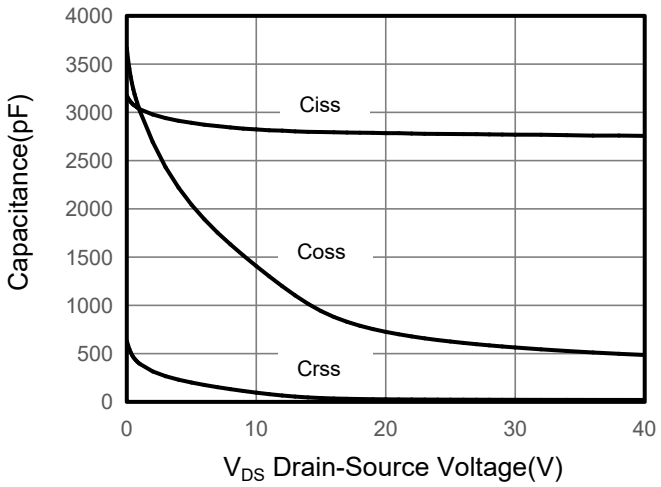
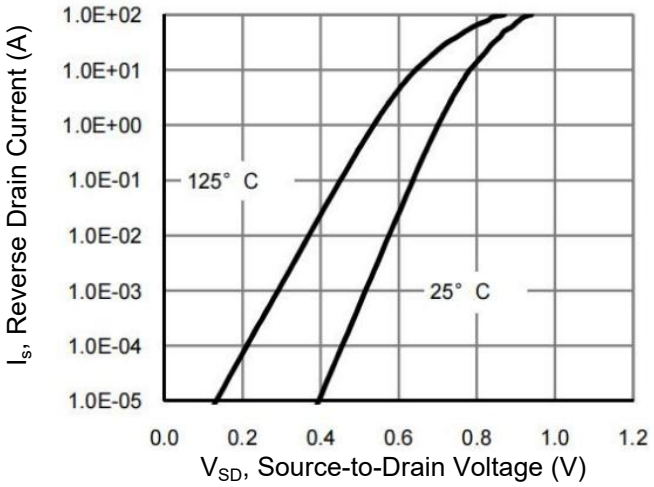



**Figure 6. Source-Drain Diode Forward**



**Typical Characteristics** $T_J$ = 25ºC, unless otherwise noted

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

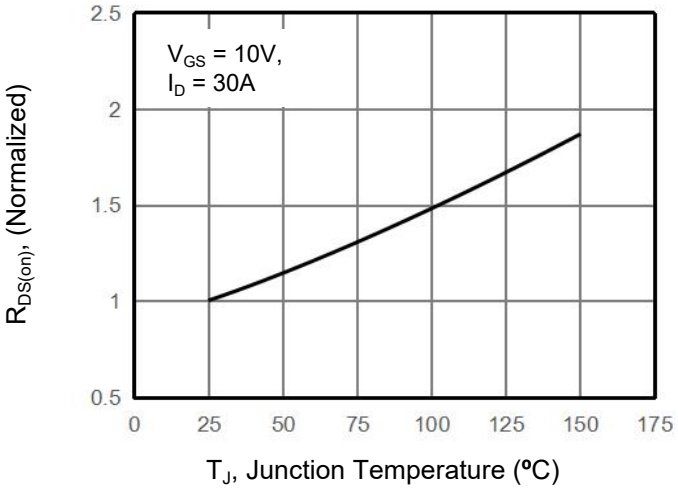



**Figure 8. Safe Operation Area**

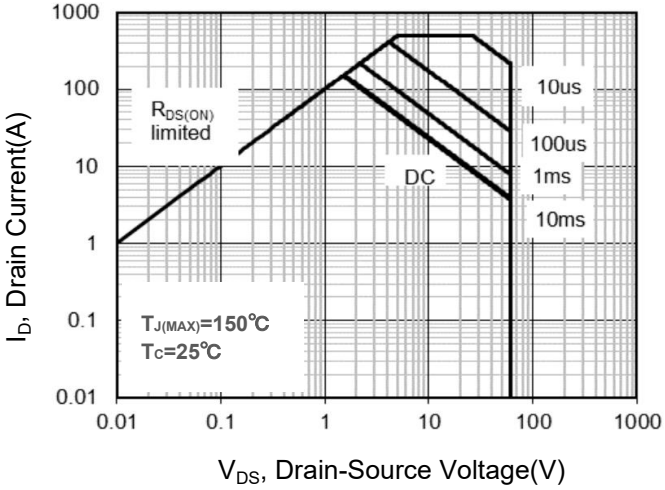
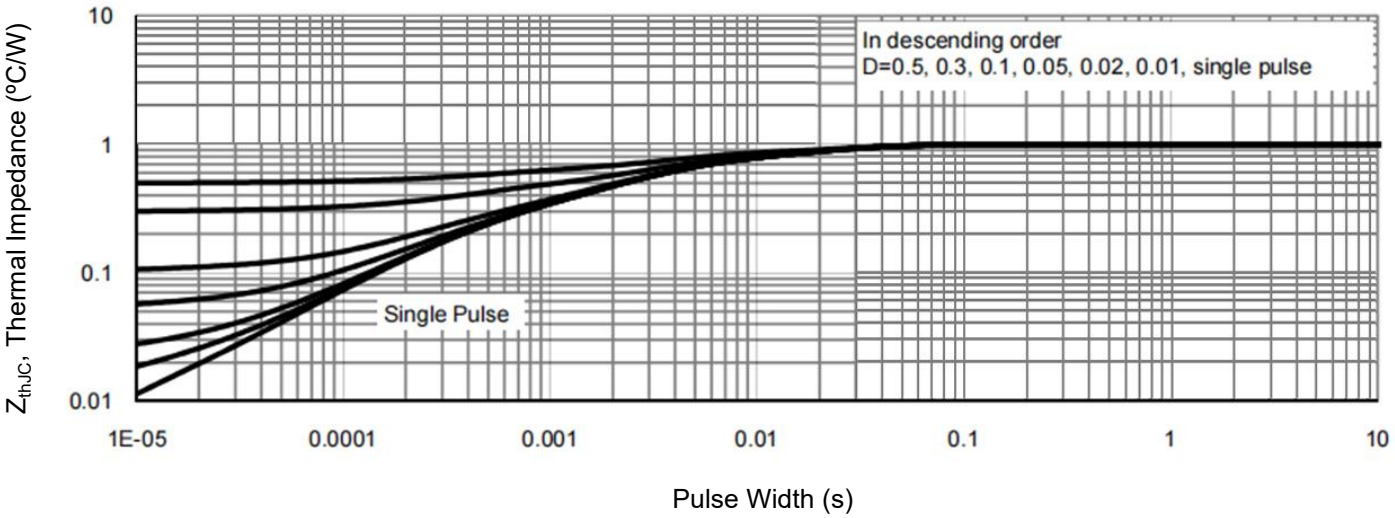
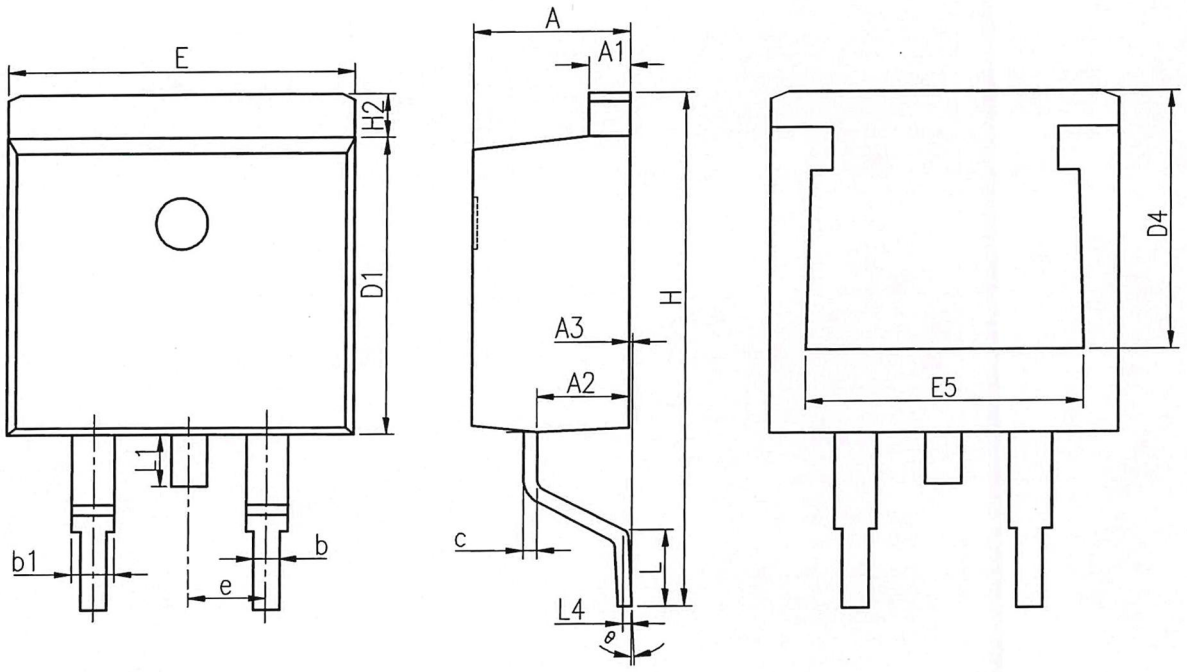



**Figure 9. Normalized Maximum Transient Thermal Impedance**



**TO-263 Package Information**




COMMON DIMENSIONS

| SYMBOL | MM | | | SYMBOL | MM | | |
|---|---|---|---|---|---|---|---|
| | MIN | NOM | MAX | | MIN | NOM | MAX |
| A | 4.37 | 4.57 | 4.77 | E | 9.86 | 10.16 | 10.36 |
| A1 | 1.22 | 1.27 | 1.42 | E5 | 7.06 | - | - |
| A2 | 2.49 | 2.69 | 2.89 | e | | 2.54 BSC | |
| A3 | 0.00 | 0.13 | 0.25 | H | 14.70 | 15.10 | 15.50 |
| b | 0.70 | 0.81 | 0.96 | H2 | 1.07 | 1.27 | 1.47 |
| b1 | 1.17 | 1.27 | 1.47 | L | 2.00 | 2.30 | 2.60 |
| c | 0.30 | 0.38 | 0.53 | L1 | 1.40 | 1.55 | 1.70 |
| D1 | 8.50 | 8.70 | 8.90 | L4 | | 0.25 BSC | |
| D4 | 6.60 | - | - | θ | 0° | 5° | 9° |