# 40H13A(文件编号：S&CIC2081) N-Channel Trench Power MOSFET

## Features

VDS=40V; ID=130A@ VGS=10V;

RDS(ON)<3.5mΩ @ VGS=10V

Ultra Low On-Resistance

High UIS and UIS 100% Test

## Application

Hard Switched and High Frequency Circuits

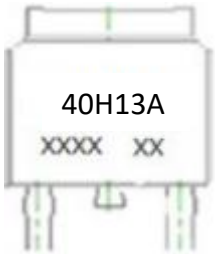
Uninterruptible Power Supply

## General Description

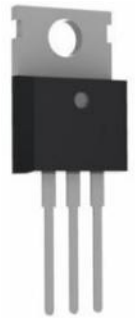
The 40H13A is N-channel MOS Field Effect Transistor designed for high current switching applications.

Rugged EAScapability and ultra low $R_{DS(ON)}$ is suitable for PWM, load switching .

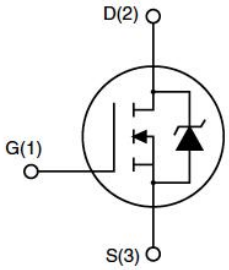
## Package




Marking and pin assignment



TO-220top view




Schematic diagram

## Package Marking and Ordering Information

| Device Marking | Device | Device Package | Reel Size | Tape width | Quantity |
|---|---|---|---|---|---|
| 40H13A | 40H13A | TO-220 | - | - | - |

## Table 1. Absolute Maximum Ratings (TA=25℃)

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{DS}$ | Drain-Source Voltage ($V_{GS}$=0V) | 40 | V |
| $V_{GS}$ | Gate-Source Voltage ($V_{DS}$=0V) | ±20 | V |
| $I_{D\ (DC)}$ | Drain Current (DC) at Tc=25℃ | 130 | A |
| $I_{D\ (DC)}$ | Drain Current (DC) at Tc=100℃ | 80 | A |
| $I_{DM\ (pluse)}$ | Drain Current-Continuous@ Current-Pulsed (Note 1) | 400 | A |
| dv/dt | Peak Diode Recovery Voltage | 1.82 | V/ns |
| $P_D$ | Maximum Power Dissipation(Tc=25℃) | 205 | W |
| | Derating Factor | 1.58 | W/℃ |
| $E_{AS}$ | Single Pulse Avalanche Energy (Note 2) | 1056 | mJ |
| $T_J$,$T_{STG}$ | Operating Junction and Storage Temperature Range | -55 To 175 | ℃ |

Notes:1.Repetitive Rating: Pulse width limited by maximum junction temperature

2.EAS condition:$T_J$=25℃,IAS=65A,$V_G$=10V, RG=25Ω

**Table 2. Thermal Characteristic**

| Symbol | Parameter | Value | Max | Unit |
|---|---|---|---|---|
| $R_{\theta JC}$ | Thermal Resistance,Junction-to-Case | --- | 0.68 | ℃/W |

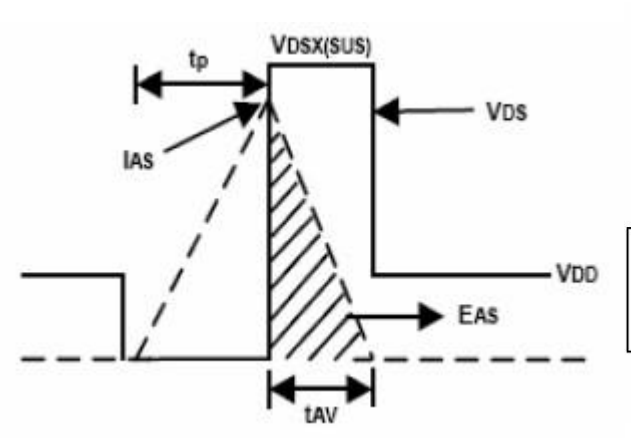
**Table 3. Electrical Characteristics (TA=25℃unless otherwise noted)**

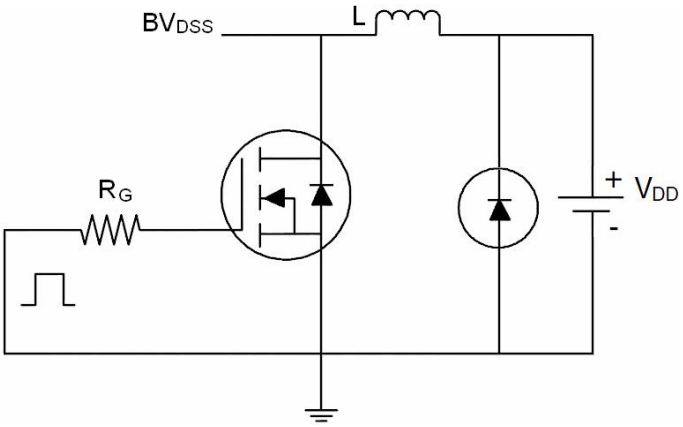
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **On/Off States** | | | | | | |
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$=0V $I_D$=250μA | 40 | | | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current(Tc=25℃) | $V_{DS}$=40V,$V_{GS}$=0V | | | 1 | μA |
| $I_{DSS}$ | Zero Gate Voltage Drain Current(Tc=125℃) | $V_{DS}$=40V,$V_{GS}$=0V | | | 1 | μA |
| $I_{GSS}$ | Gate-Body Leakage Current | $V_{GS}$=±20V,$V_{DS}$=0V | | | ±100 | nA |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$=$V_{GS}$,$I_D$=250μA | 1.1 | 1.6 | 2.5 | V |
| $R_{DS(ON)}$ | Drain-Source On-State Resistance | $V_{GS}$=10V, $I_D$=40A | | 2.8 | 3.5 | mΩ |
| **Dynamic Characteristics** | | | | | | |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$=10V,$I_D$=40A | 45 | | | S |
| $C_{iss}$ | Input Capacitance | $V_{DS}$=25V,$V_{GS}$=0V f=1.0MHz | | 6880 | | PF |
| $C_{oss}$ | Output Capacitance | | | 956 | | PF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 654 | | PF |
| $Q_g$ | Total Gate Charge | $V_{DS}$=32V,$I_D$=75A $V_{GS}$=10V | | 148 | | nC |
| $Q_{gs}$ | Gate-Source Charge | | | 42 | | nC |
| $Q_{gd}$ | Gate-Drain Charge | | | 58 | | nC |
| **Switching Times** | | | | | | |
| $t_{d(on)}$ | Turn-on Delay Time | $V_{DD}$=20V,$I_D$=75A $V_{GS}$=10V,$R_G$=3.0Ω | | 44 | | nS |
| $t_r$ | Turn-on Rise Time | | | 52 | | nS |
| $t_{d(off)}$ | Turn-Off Delay Time | | | 68 | | nS |
| $t_f$ | Turn-Off Fall Time | | | 24 | | nS |
| **Source-Drain Diode Characteristics** | | | | | | |
| $I_{SD}$ | Source-Drain Current(Body Diode) | | | 130 | | A |
| $I_{SDM}$ | Pulsed Source-Drain Current(Body Diode) | | | 400 | | A |
| $V_{SD}$ | Forward On Voltage(Note 1) | $T_J$=25℃,$I_{SD}$=40A,$V_{GS}$=0V | | 0.91 | 1.2 | V |
| $t_{rr}$ | Reverse Recovery Time(Note 1) | $T_J$=25℃,$I_F$=40A di/dt=100A/μs | | 26 | | nS |
| $Q_{rr}$ | Reverse Recovery Charge(Note 1) | | | 22 | | nC |
| $t_{on}$ | Forward Turn-on Time | Intrinsic turn-on time is negligible(turn-on is dominated by $L_S$+$L_D$) | | | | |

Notes 1.Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 1.5%, $R_G$=25Ω, Starting $T_J$=25℃

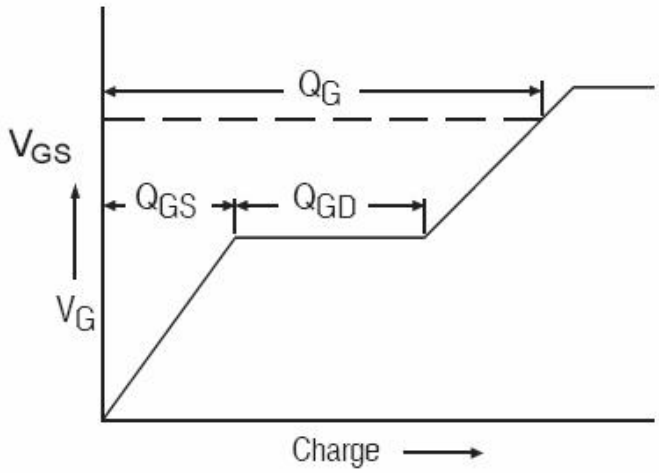
## Test Circuit

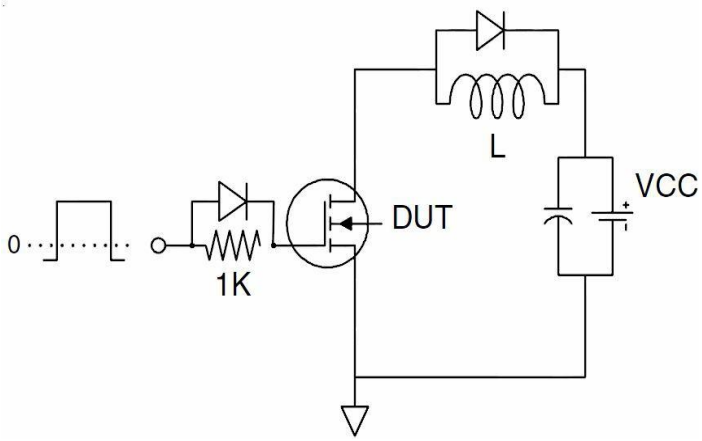
1) $E_{AS}$ Test Circuits



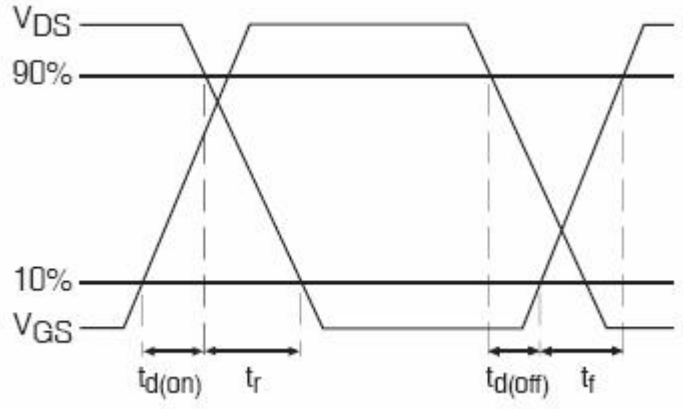



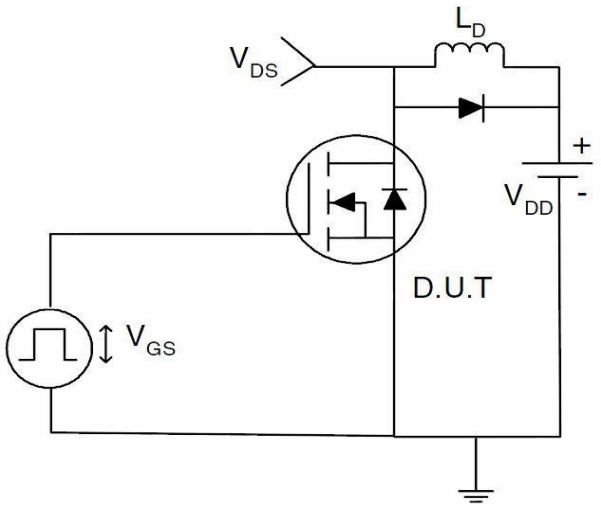

2) Gate Charge Test Circuit:




3) Switch Time TestCircuit：



## YPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (Curves)

**Figure1. Output Characteristics**

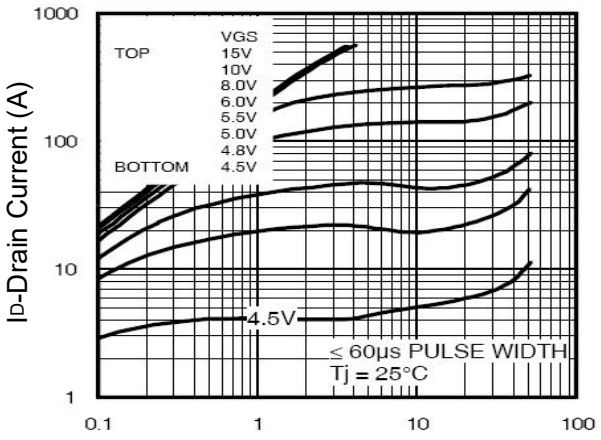



**Figure2. Transfer Characteristics**

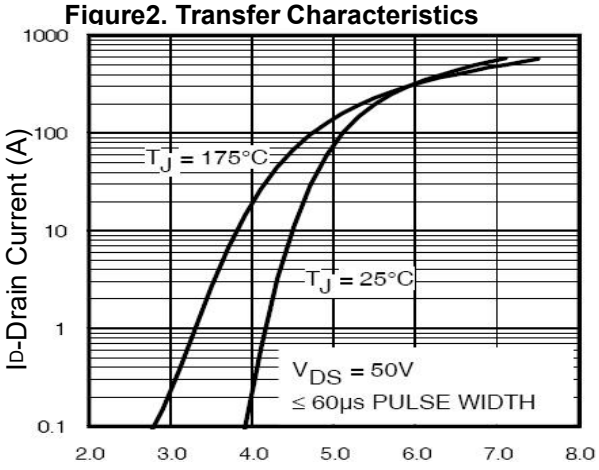



**Figure3. VGS(th) vs Junction Temperature**

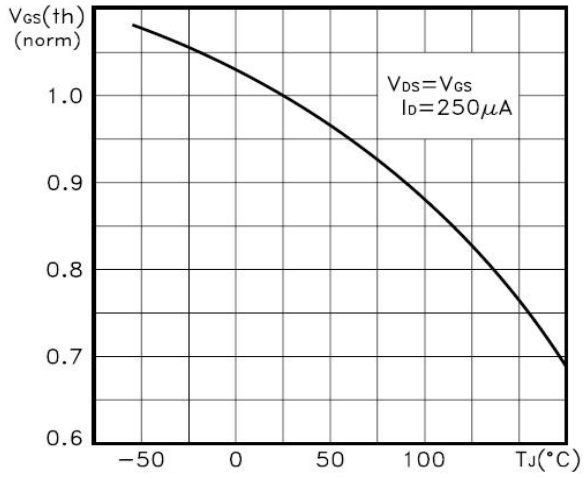



**Figure4. BVDSS vs Junction Temperature**

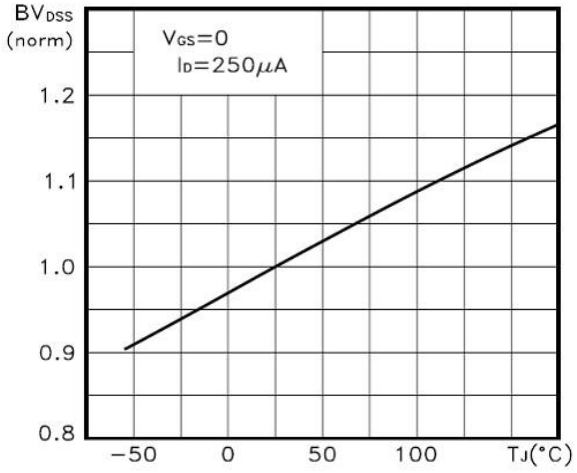



**Figure5. ID vs Junction Temperature**

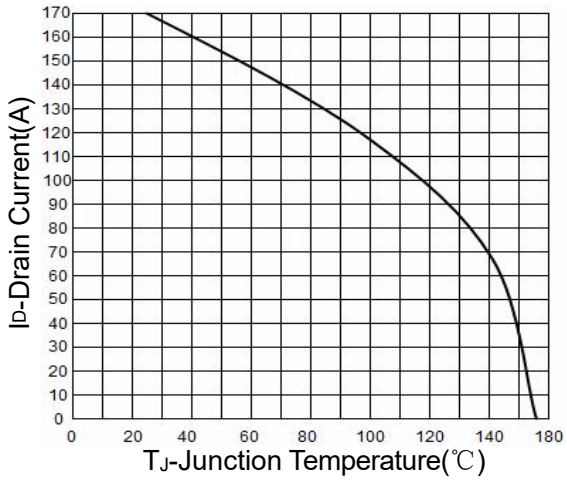



**Figure6. $R_{DS(ON)}$- JunctionTemperature**

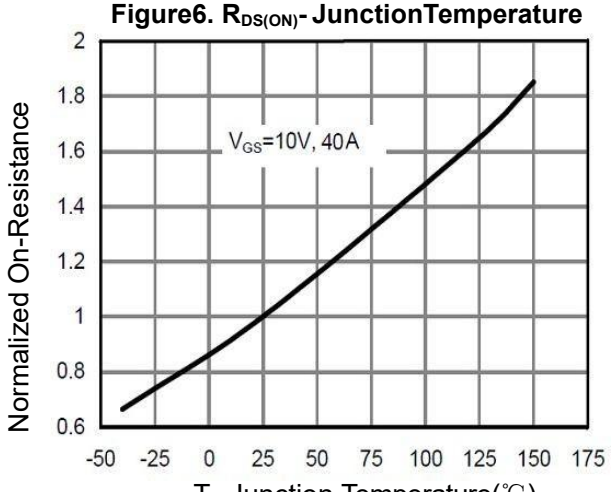


**Figure7. Gate Charge**

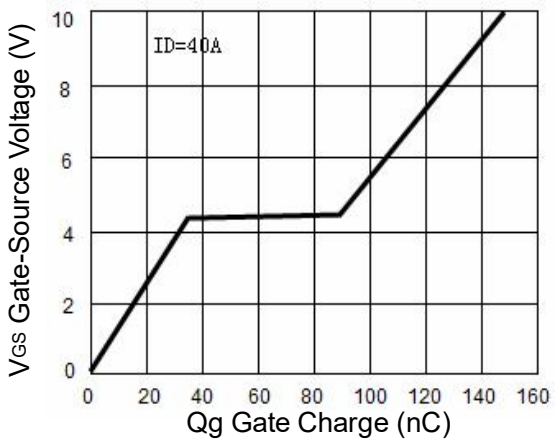



**Figure8. Capacitance vs VDS**

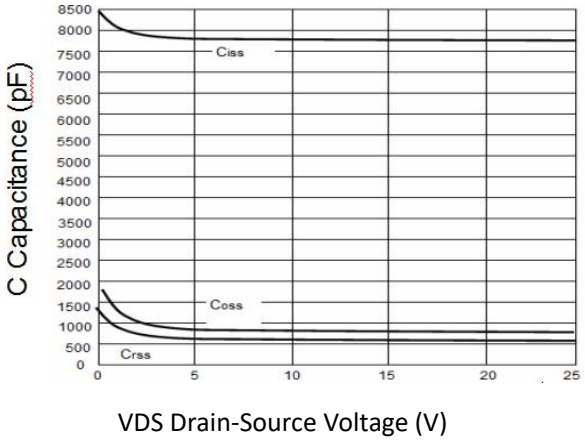



**Figure9. Source- Drain Diode Forward**

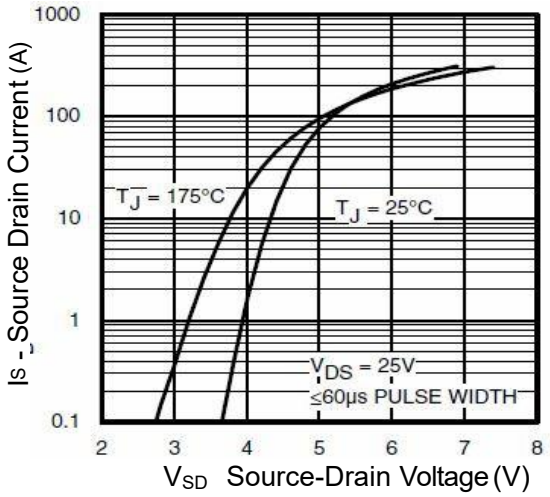



**Figure10. Safe Operation Area**

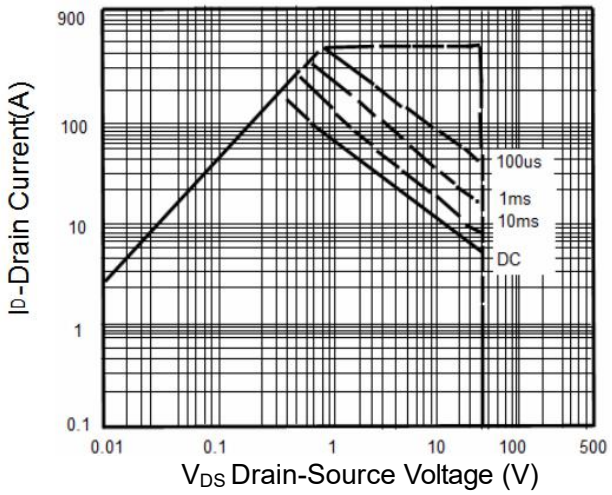
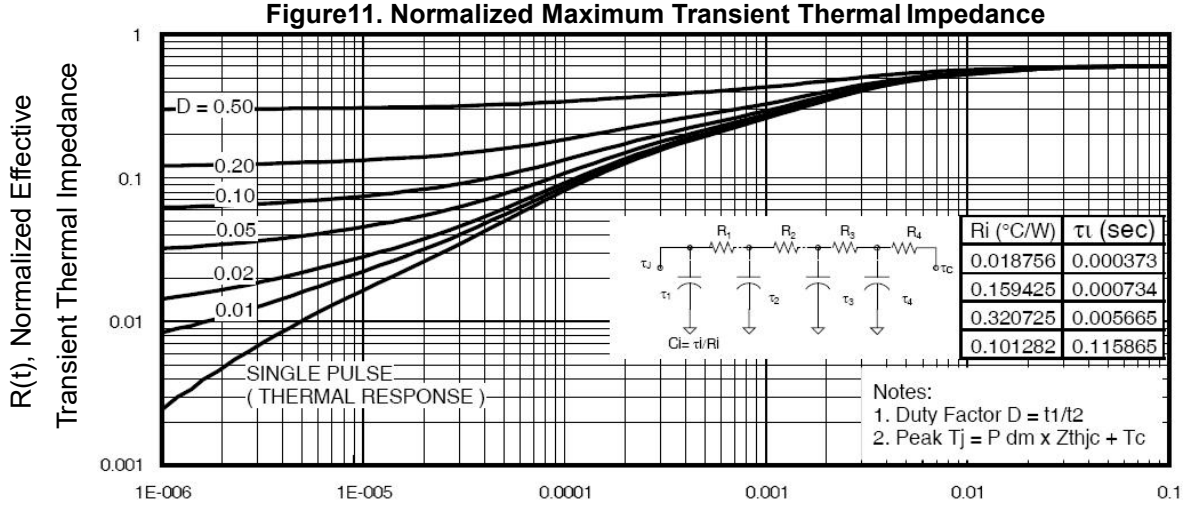
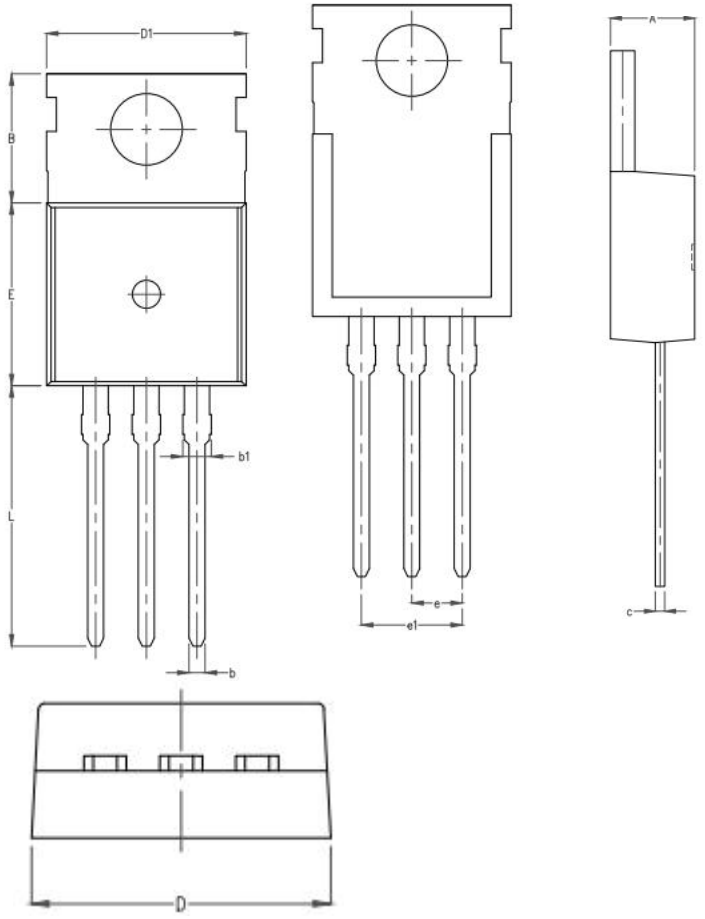



**Figure11. Normalized Maximum Transient Thermal Impedance**



# TO-220 Package Information




| SYMBOL | MILLIMETER | | |
|---|---|---|---|
| | MIN | NOM | MAX |
| A | 4.45 | 4.50 | 4.55 |
| B | 6.40 | 6.50 | 6.60 |
| b | | 0.80TYP. | |
| b1 | 1.24 | 1.27 | 1.30 |
| c | 0.48 | 0.50 | 0.52 |
| D | 9.95 | 10.00 | 10.05 |
| D1 | 9.80 | 10.00 | 10.20 |
| E | 9.15 | 9.20 | 9.25 |
| e | 2.51 | 2.54 | 2.57 |
| e1 | 5.05 | 5.08 | 5.11 |
| L | 12.95 | 13.10 | 13.25 |