# N-Channel Trench Power MOSFET

## General Description

The CS55N53 is N-channel MOS Field Effect Transistor designed for high current switching applications. Rugged $E_{AS}$ capability and ultra low $R_{DS(ON)}$ is suitable for PWM, load switching applications.

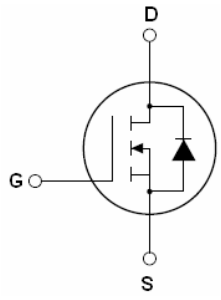
## Features

- $V_{DS}$=55V； $I_D$=100A@ $V_{GS}$=10V；
  $R_{DS(ON)}$<6.4mΩ @ $V_{GS}$=10V
- Ultra Low On-Resistance
- High UIS and UIS 100% Test

## Application

- Hard Switched and High Frequency Circuits
- Uninterruptible Power Supply


**To-220 Top View**




**Schematic Diagram**

$V_{DS}$ = 55V

$I_D$ = 100A

$R_{DS(ON)}$ = 5.0mΩ

## Package Marking and Ordering Information

| Device Marking | Device | Device Package | Reel Size | Tape width | Quantity |
|---|---|---|---|---|---|
| CS55N53 | CS55N53 | TO-220 | - | - | - |

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

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{DS}$ | Drain-Source Voltage ($V_{GS}$=0V) | 55 | V |
| $V_{GS}$ | Gate-Source Voltage ($V_{DS}$=0V) | ±20 | V |
| $I_{D\ (DC)}$ | Drain Current (DC) at Tc=25℃ | 100 | A |
| $I_{D\ (DC)}$ | Drain Current (DC) at Tc=100℃ | 70 | A |
| $I_{DM\ (pluse)}$ | Drain Current-Continuous@ Current-Pulsed **(Note 1)** | 400 | A |
| dv/dt | Peak Diode Recovery Voltage | 8.8 | V/ns |
| $P_D$ | Maximum Power Dissipation(Tc=25℃) | 120 | W |
| | Derating Factor | 0.8 | W/℃ |
| $E_{AS}$ | Single Pulse Avalanche Energy **(Note 2)** | 440 | 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.$E_{AS}$ condition:$T_J$=25℃,$V_{DD}$=33V,$V_G$=10V,$I_D$=45A

**Table 2. Thermal Characteristic**

| Symbol | Parameter | Value | Max | Unit |
|---|---|---|---|---|
| $R_{\theta JC}$ | Thermal Resistance,Junction-to-Case | --- | 1.25 | ℃/W |

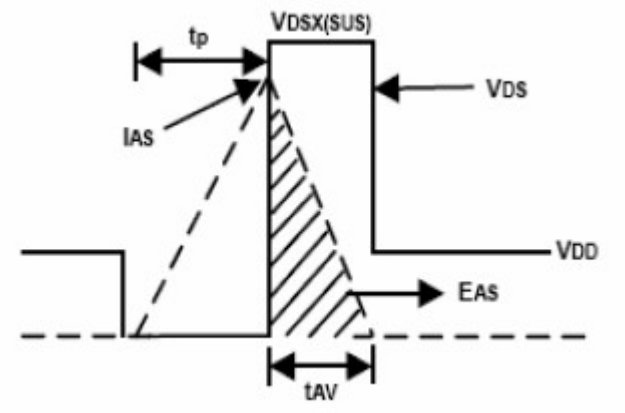
**Table 3. Electrical Characteristics (TA=25℃unless otherwise noted)**

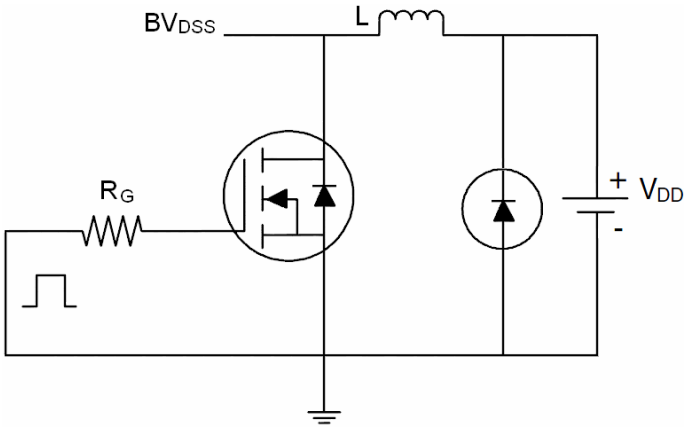
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **On/Off States** | | | | | | |
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$=0V $I_D$=250μA | 55 | | | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current(Tc=25℃) | $V_{DS}$=68V,$V_{GS}$=0V | | | 1 | μA |
| $I_{DSS}$ | Zero Gate Voltage Drain Current(Tc=125℃) | $V_{DS}$=68V,$V_{GS}$=0V | | | 10 | μA |
| $I_{GSS}$ | Gate-Body Leakage Current | $V_{GS}$=±25V,$V_{DS}$=0V | | | ±100 | nA |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$=$V_{GS}$,$I_D$=250μA | 1 | | 2 | V |
| $R_{DS(ON)}$ | Drain-Source On-State Resistance | $V_{GS}$=10V, $I_D$=40A | | 5.0 | 6.4 | mΩ |
| $R_{DS(ON)}$ | Drain-Source On-State Resistance | $V_{GS}$=4.5V, $I_D$=4A | | 6.0 | 8.4 | mΩ |
| **Dynamic Characteristics** | | | | | | |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$=10V,$I_D$=15A | 20 | | | S |
| $C_{iss}$ | Input Capacitance | $V_{DS}$=25V,$V_{GS}$=0V, f=1.0MHz | | 5538 | | pF |
| $C_{oss}$ | Output Capacitance | | | 380 | | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 304 | | pF |
| $Q_g$ | Total Gate Charge | $V_{DS}$=50V,$I_D$=40A, $V_{GS}$=10V | | 102 | | nC |
| $Q_{gs}$ | Gate-Source Charge | | | 20 | | nC |
| $Q_{gd}$ | Gate-Drain Charge | | | 49 | | nC |
| **Switching Times** | | | | | | |
| $t_{d(on)}$ | Turn-on Delay Time | $V_{DD}$=30V,$I_D$=2A,$R_L$=15Ω $V_{GS}$=10V,$R_G$=2.5Ω | | 24 | | nS |
| $t_r$ | Turn-on Rise Time | | | 32 | | nS |
| $t_{d(off)}$ | Turn-Off Delay Time | | | 69 | | nS |
| $t_f$ | Turn-Off Fall Time | | | 31 | | nS |
| **Source-Drain Diode Characteristics** | | | | | | |
| $I_{SD}$ | Source-Drain Current(Body Diode) | | | 100 | | 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 | | 0.9 | 0.99 | V |
| $t_{rr}$ | Reverse Recovery Time**(Note 1)** | $T_J$=25℃,$I_F$=75A di/dt=100A/μs | | 28 | | nS |
| $Q_{rr}$ | Reverse Recovery Charge**(Note 1)** | | | 39 | | 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℃

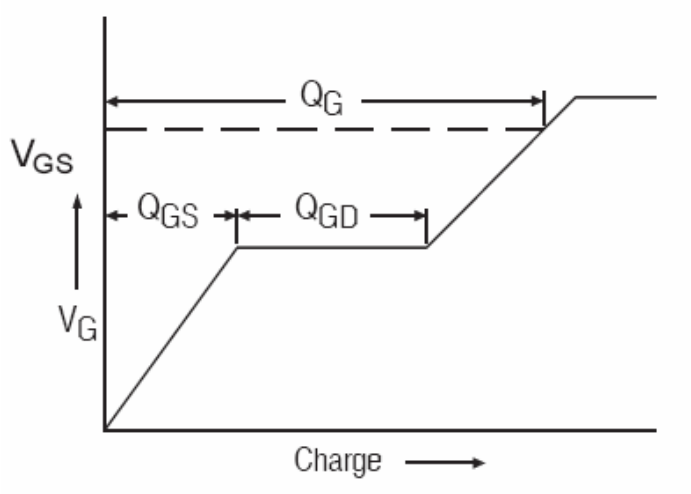
## Test Circuit

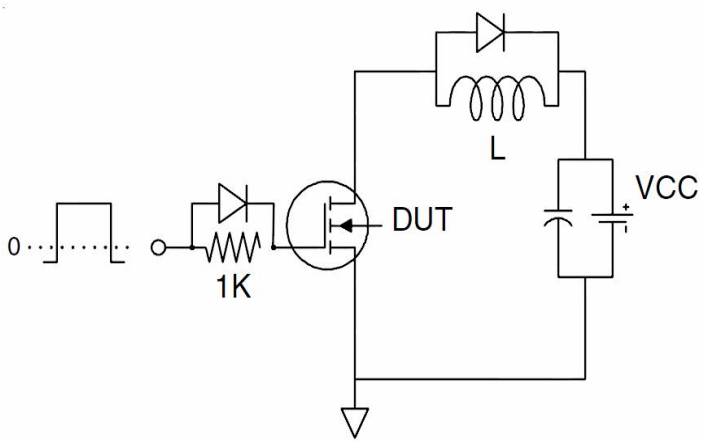
### 1）$E_{AS}$ Test Circuits



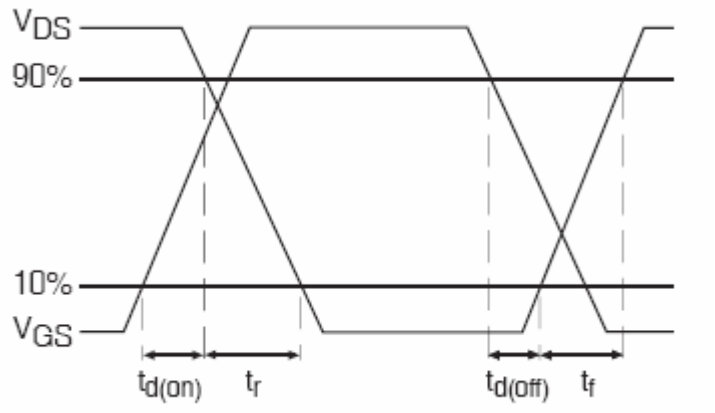



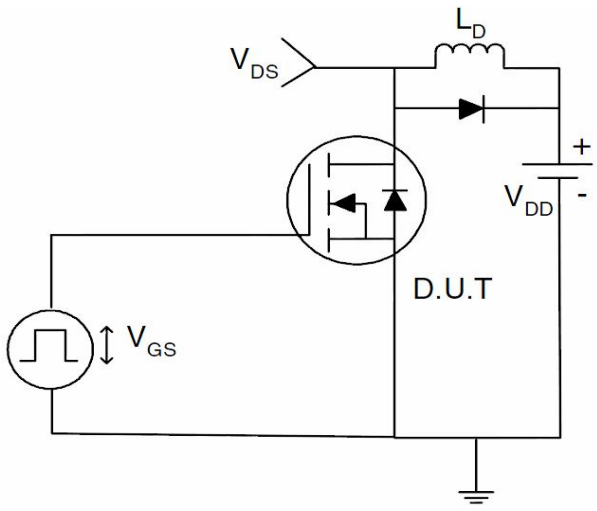

### 2）Gate Charge Test Circuit:




### 3）Switch Time Test Circuit：



## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (Curves)

**Figure1. Output Characteristics**

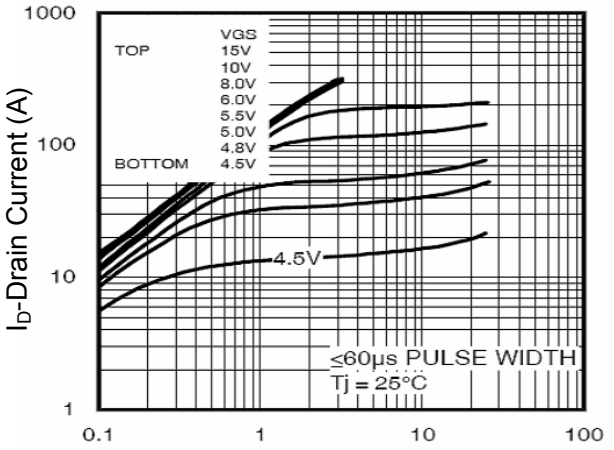



**Figure2. Transfer Characteristics**

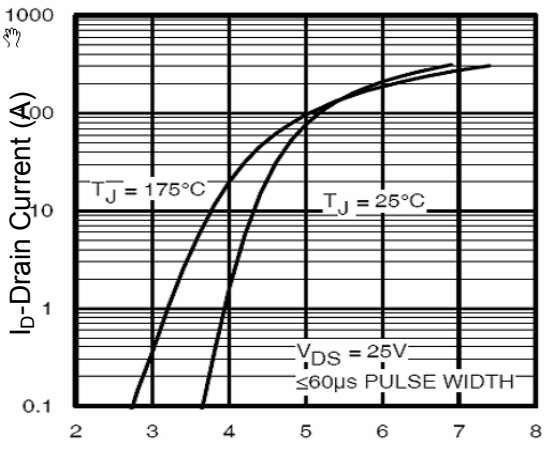



**Figure3. BVDSS vs Junction Temperature**

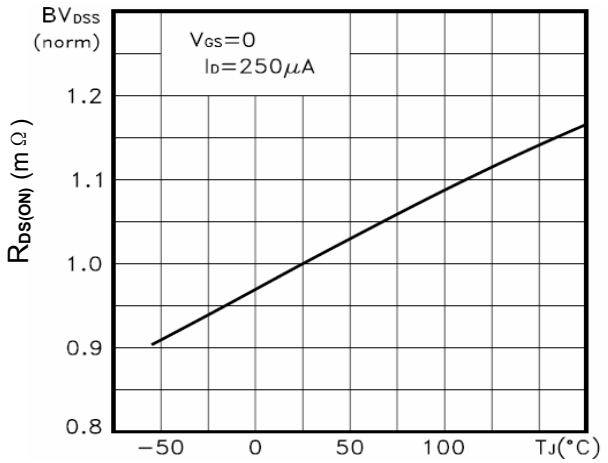



**Figure4. ID vs Junction Temperature**

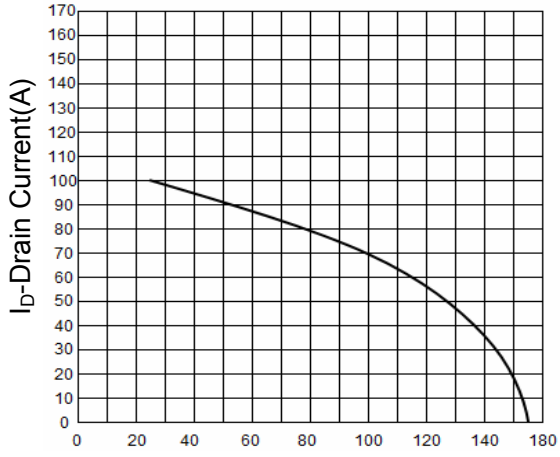



**Figure5. Rdson Vs Junction Temperature**

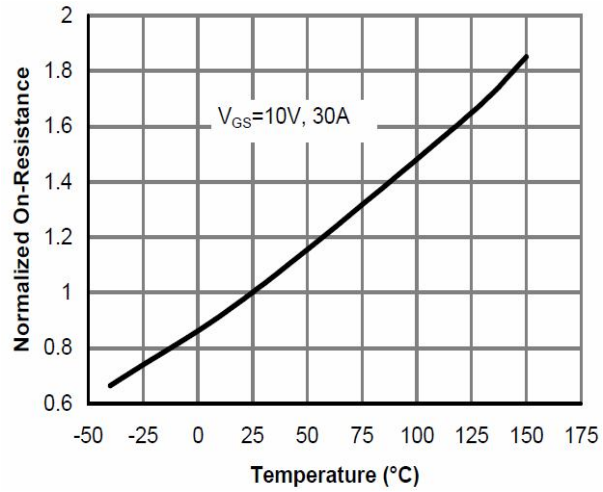



**Figure6. $V_{GS(th)}$ vs Junction Temperature**

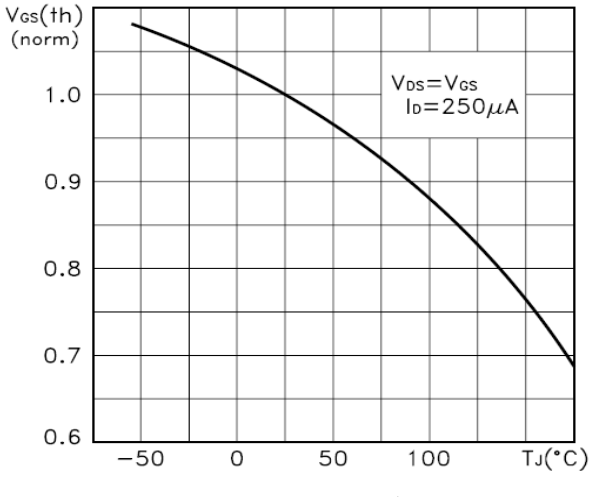


**Figure7. Gate Charge**

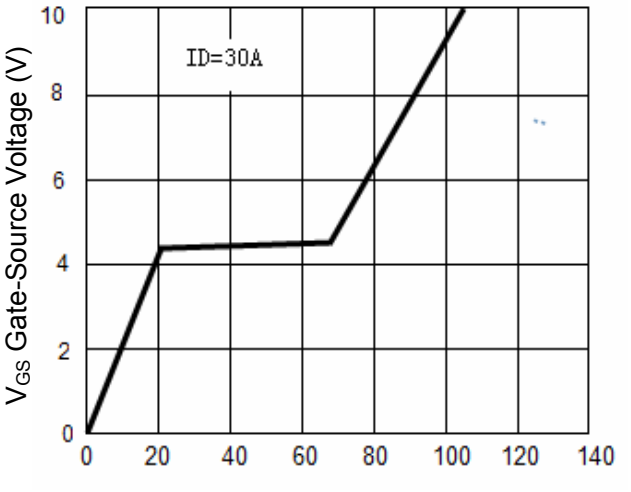



**Figure8. Capacitance vs Vds**

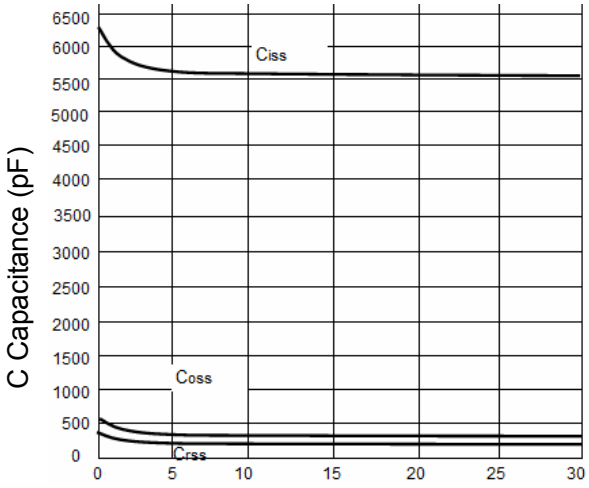



**Figure9. Source- Drain Diode Forward**

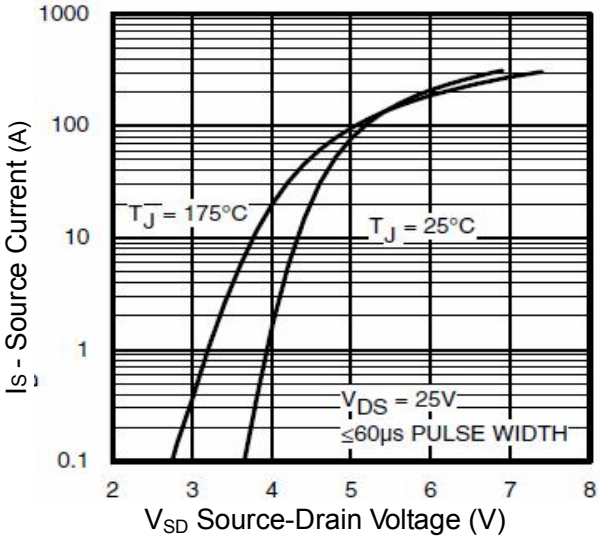



**Figure10. Safe Operation Area**

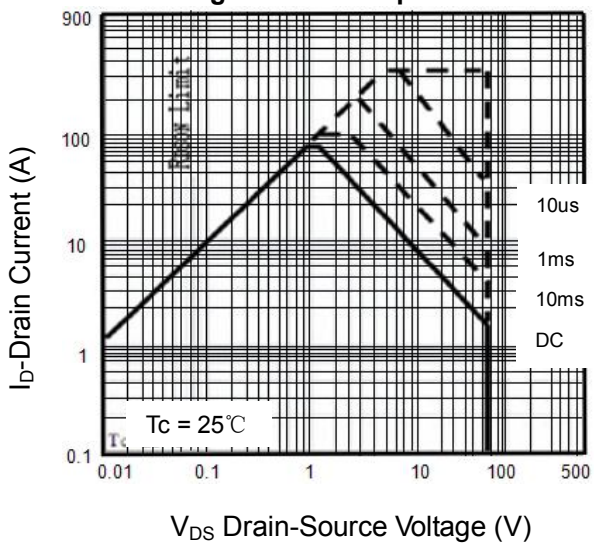
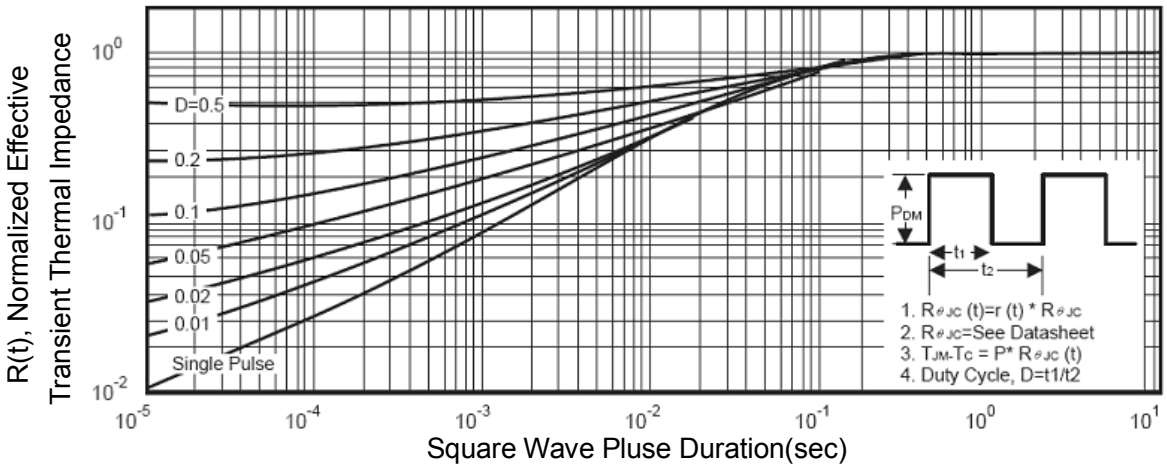
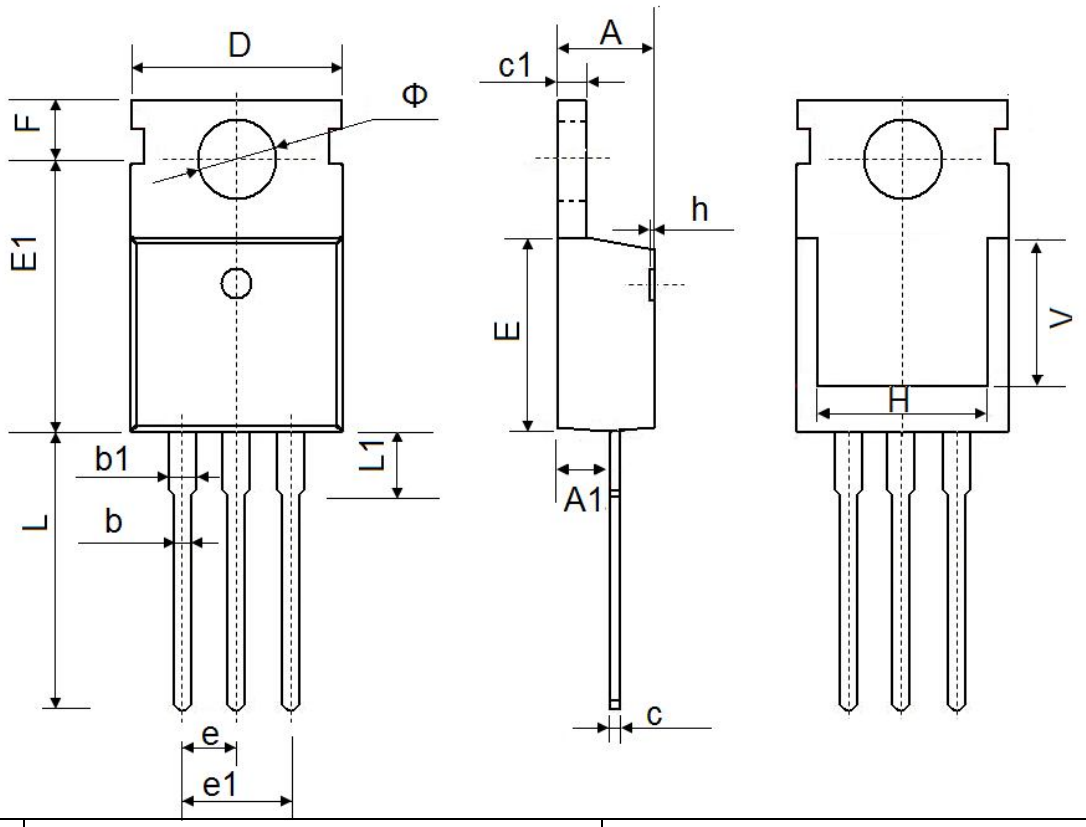



**Figure11. Normalized Maximum Transient Thermal Impedance**



# TO-220 Package Information




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min. | Max. | Min. | Max |
| A | 4.300 | 4.700 | 0.169 | 0.185 |
| A1 | 2.200 | 2.600 | 0.087 | 0.102 |
| b | 0.700 | 0.950 | 0.028 | 0.037 |
| b1 | 1.170 | 1.410 | 0.046 | 0.056 |
| c | 0.450 | 0.650 | 0.018 | 0.026 |
| c1 | 1.200 | 1.400 | 0.047 | 0.055 |
| D | 9.600 | 10.400 | 0.378 | 0.409 |
| E | 8.8500 | 9.750 | 0.348 | 0.384 |
| E1 | 12.650 | 12.950 | 0.498 | 0.510 |
| e | 2.540 TYP. | | 0.100TYP. | |
| e1 | 4.980 | 5.180 | 0.196 | 0.204 |
| F | 2.650 | 2.950 | 0.104 | 0.116 |
| H | 7.900 | 8.100 | 0.311 | 0.319 |
| h | 0.000 | 0.300 | 0.000 | 0.012 |
| L | 12.750 | 14.300 | 0.502 | 0.563 |
| L1 | 2.850 | 3.950 | 0.112 | 0.156 |
| V | 7.500 REF. | | 0.295 REF. | |
| Φ | 3.400 | 4.000 | 0.134 | 0.157 |