# NCE N-Channel Enhancement Mode Power MOSFET

## Description

The NCE85H21T uses advanced trench technology and design to provide excellent $R_{DS(ON)}$ with low gate charge. It can be used in automotive applications and a wide variety of other applications.

## General Features

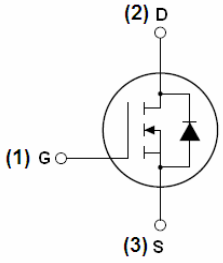
- $V_{DSS}$ =85V,$I_D$ =210A
  $R_{DS(ON)}$ < 4.5mΩ @ $V_{GS}$=10V
- Good stability and uniformity with high $E_{AS}$
- Special process technology for high ESD capability
- High density cell design for ultra low Rdson
- Fully characterized avalanche voltage and current
- Excellent package for good heat dissipation

## Application

- Automotive applications
- Hard switched and high frequency circuits
- Uninterruptible power supply

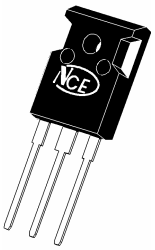
***100% UIS TESTED!***

***100% ΔVds TESTED!***




**Schematic diagram**


**Marking and pin assignment**




**TO-247 top view**

## Package Marking and Ordering Information

| Device Marking | Device | Device Package | Reel Size | Tape width | Quantity |
|---|---|---|---|---|---|
| NCE85H21T | NCE85H21T | TO-247 | - | - | - |

## Absolute Maximum Ratings ($T_C$=25℃unless otherwise noted)

| Parameter | Symbol | Limit | Unit |
|---|---|---|---|
| Drain-Source Voltage | $V_{DSS}$ | 85 | V |
| Gate-Source Voltage | $V_{GS}$ | ±20 | V |
| Drain Current-Continuous | $I_D$ | 210 | A |
| Drain Current-Continuous($T_C$=100℃) | $I_D$ (100℃) | 150 | A |
| Pulsed Drain Current | $I_{DM}$ | 850 | A |
| Maximum Power Dissipation | $P_D$ | 330 | W |
| Derating factor | | 2.2 | W/℃ |
| Single pulse avalanche energy (Note 3) | $E_{AS}$ | 2200 | mJ |
| Peak Diode Recovery dv/dt (Note 4) | dv/dt | 5 | V/ns |
| Operating Junction and Storage Temperature Range | $T_J$,$T_{STG}$ | -55 To 175 | ℃ |

## Thermal Characteristic

| | | | |
|---|---|---|---|
| Thermal Resistance,Junction-to-Case (Note 1) | $R_{\theta JC}$ | 0.45 | ℃/W |

## Electrical Characteristics ($T_C$=25℃unless otherwise noted)

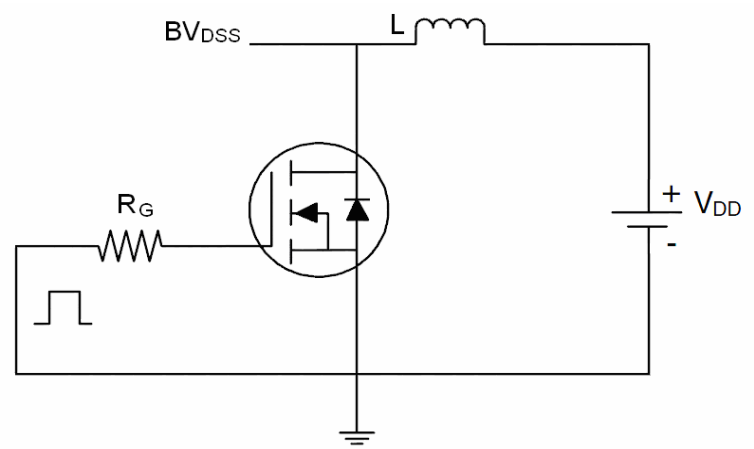
| Parameter | | Symbol | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | | |
| Drain-Source Breakdown Voltage | | $BV_{DSS}$ | $V_{GS}$=0V $I_D$=250μA | 85 | - | - | V |
| Zero Gate Voltage Drain Current | | $I_{DSS}$ | $V_{DS}$=85V,$V_{GS}$=0V | - | - | 1 | μA |
| Gate-Body Leakage Current | | $I_{GSS}$ | $V_{GS}$=±20V,$V_{DS}$=0V | - | - | ±200 | nA |
| **On Characteristics** | | | | | | | |
| Gate Threshold Voltage | | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$,$I_D$=250μA | 2 | 3 | 4 | V |
| Drain-Source On-State Resistance | 25℃ | $R_{DS(ON)}$ | $V_{GS}$=10V, $I_D$=40A | - | 3.2 | 4.5 | mΩ |
| | 125℃ | | | - | 5 | 6.8 | mΩ |
| Forward Transconductance | | $g_{FS}$ | $V_{DS}$=25V,$I_D$=40A | 100 | 165 | - | S |
| **Dynamic Characteristics** | | | | | | | |
| Input Capacitance | | $C_{lss}$ | $V_{DS}$=25V,$V_{GS}$=0V, F=1.0MHz | - | 11000 | - | PF |
| Output Capacitance | | $C_{oss}$ | | - | 914 | - | PF |
| Reverse Transfer Capacitance | | $C_{rss}$ | | - | 695 | - | PF |
| **Switching Characteristics** | | | | | | | |
| Turn-on Delay Time | | $t_{d(on)}$ | $V_{DD}$=30V,$I_D$=2A,$R_L$=15Ω $V_{GS}$=10V,$R_G$=2.5Ω | - | 23 | - | nS |
| Turn-on Rise Time | | $t_r$ | | - | 190 | - | nS |
| Turn-Off Delay Time | | $t_{d(off)}$ | | - | 130 | - | nS |
| Turn-Off Fall Time | | $t_f$ | | - | 120 | - | nS |
| Total Gate Charge | | $Q_g$ | ID=30A,VDD=30V,VGS=10V | - | 250 | - | nC |
| Gate-Source Charge | | $Q_{gs}$ | | - | 48 | - | nC |
| Gate-Drain Charge | | $Q_{gd}$ | | - | 98 | - | nC |
| **Drain-Source Diode Characteristics** | | | | | | | |
| Diode Forward Voltage | | $V_{SD}$ | $V_{GS}$=0V,$I_S$=40A | - | - | 1.2 | V |
| Reverse Recovery Time | | $t_{rr}$ | TJ = 25°C, IF = 40A di/dt = 100A/μs(Note2) | - | 63 | - | nS |
| Reverse Recovery Charge | | Qrr | | - | 98 | - | nC |
| Forward Turn-On Time | | $t_{on}$ | Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD) | | | | |

## Notes:

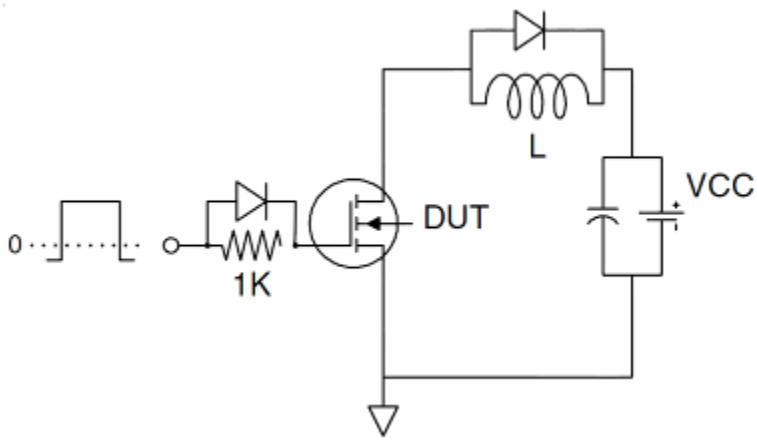
1. Surface Mounted on FR4 Board, t ≤ 10 sec.
2. Pulse Test: Pulse Width ≤ 400μs, Duty Cycle ≤ 2%.
3. EAS condition：Tj=25℃,$V_{DD}$=42.5V,$V_G$=10V,L=2mH,Rg=25Ω,$I_{AS}$=37A
4. $I_{SD}$≤125A, di/dt≤260A/μs, $V_{DD}$≤$V_{(BR)DSS}$，$T_J$ ≤175°C

## Test Circuit

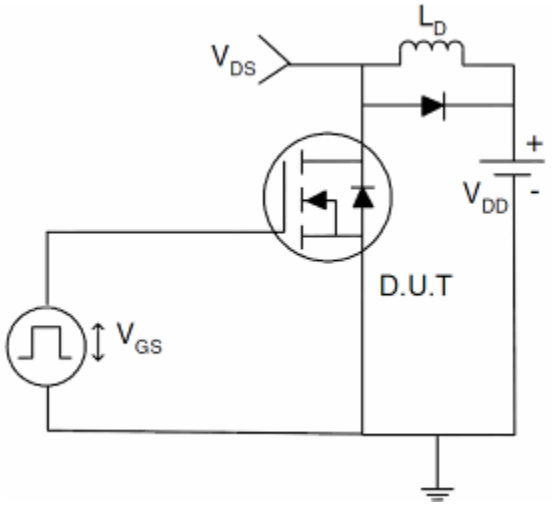
### 1）$E_{AS}$ test Circuit



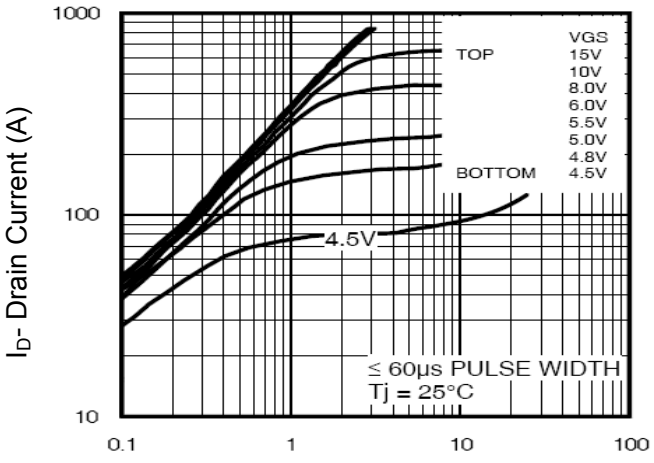

### 2）Gate charge test Circuit




### 3）Switch Time Test Circuit

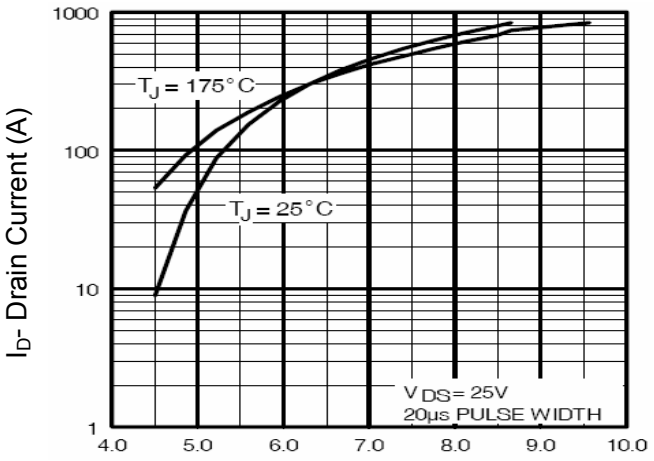


## Typical Electrical and Thermal Characteristics



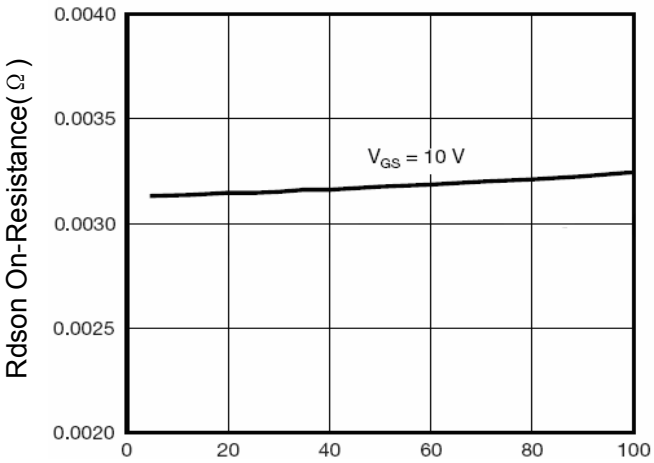

Vds Drain-Source Voltage (V)

**Figure 1 Output Characteristics**



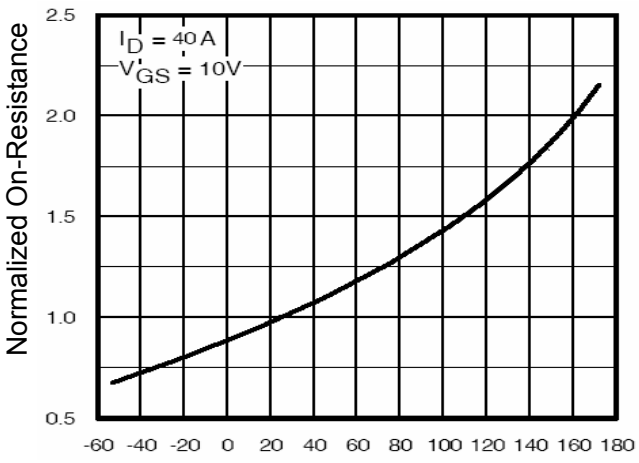

Vgs Gate-Source Voltage (V)

**Figure 2 Transfer Characteristics**



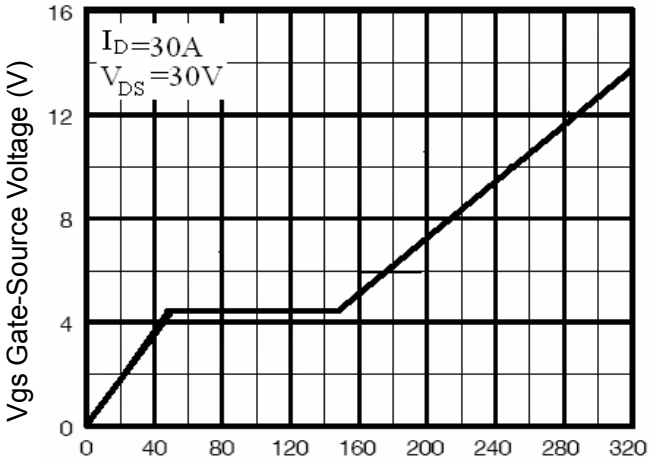

$I_D$- Drain Current (A)

**Figure 3 Rdson- Drain Current**



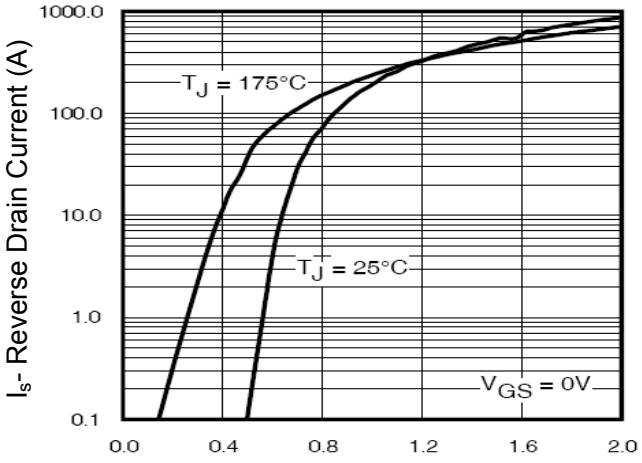

$T_J$-Junction Temperature(℃)

**Figure 4 Rdson-JunctionTemperature**




Qg Gate Charge (nC)

**Figure 5 Gate Charge**




Vsd Source-Drain Voltage (V)

**Figure 6 Source- Drain Diode Forward**

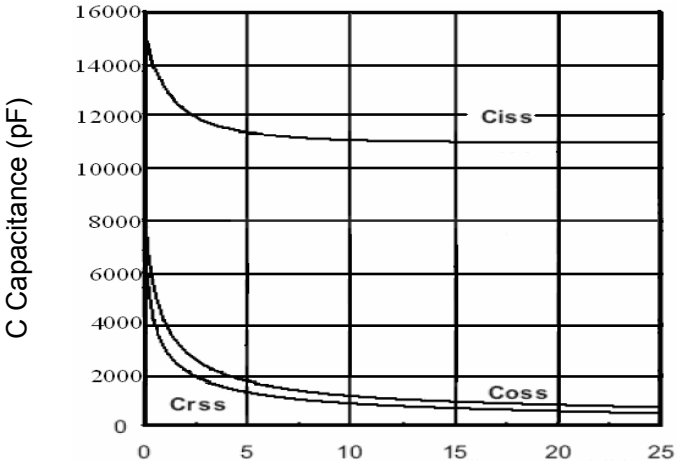



**Figure 7 Capacitance vs Vds**

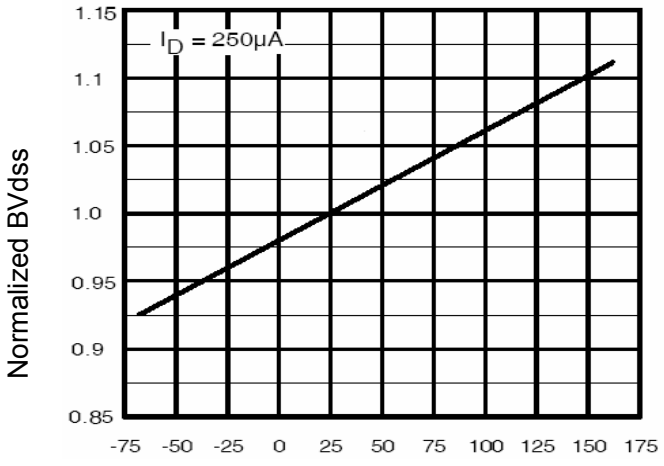



**Figure 9 $BV_{DSS}$ vs Junction Temperature**

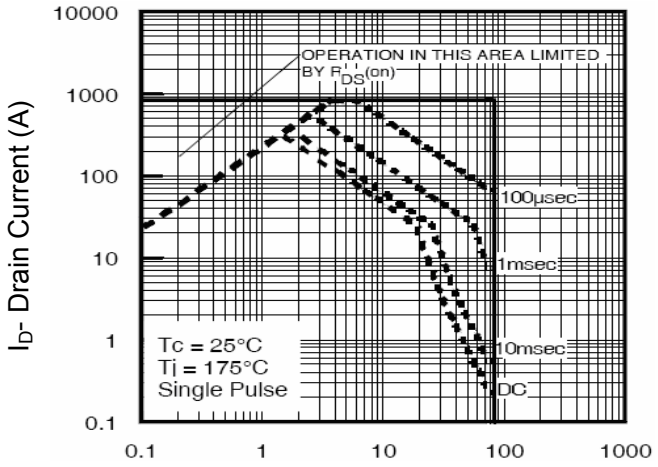



**Figure 8 Safe Operation Area**

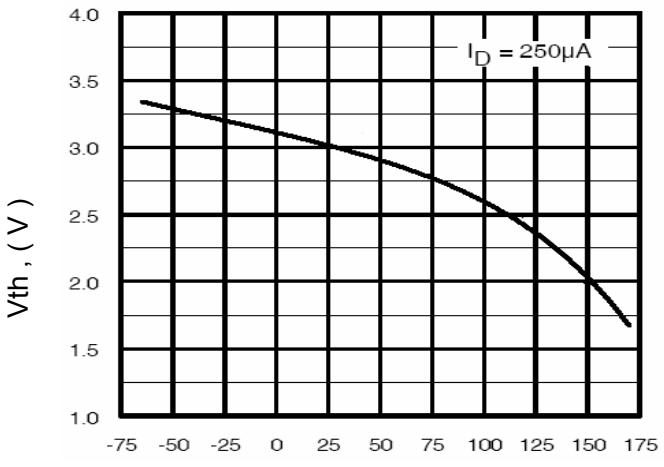



**Figure 10 $V_{GS(th)}$ vs Junction Temperature**

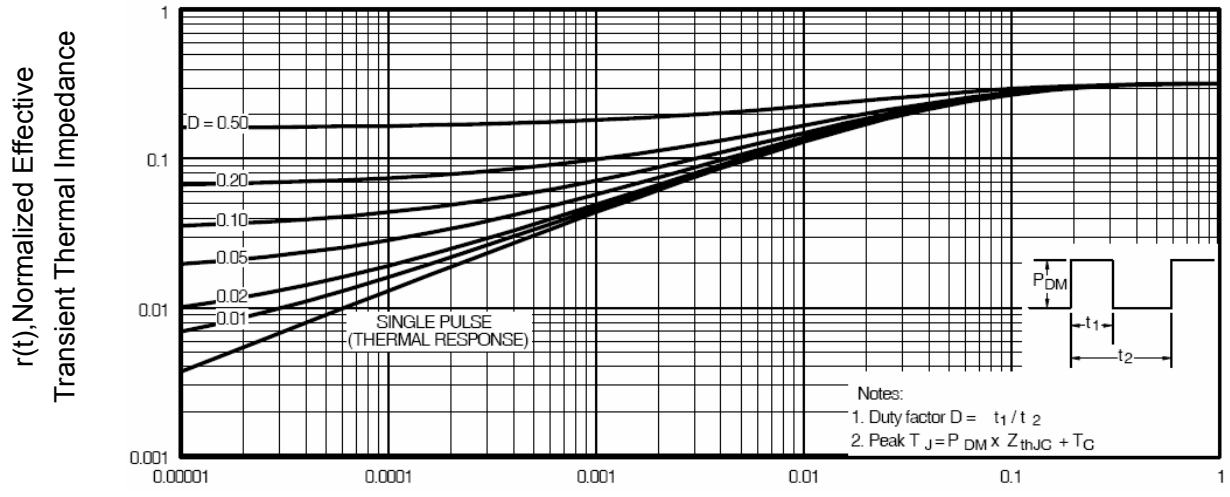
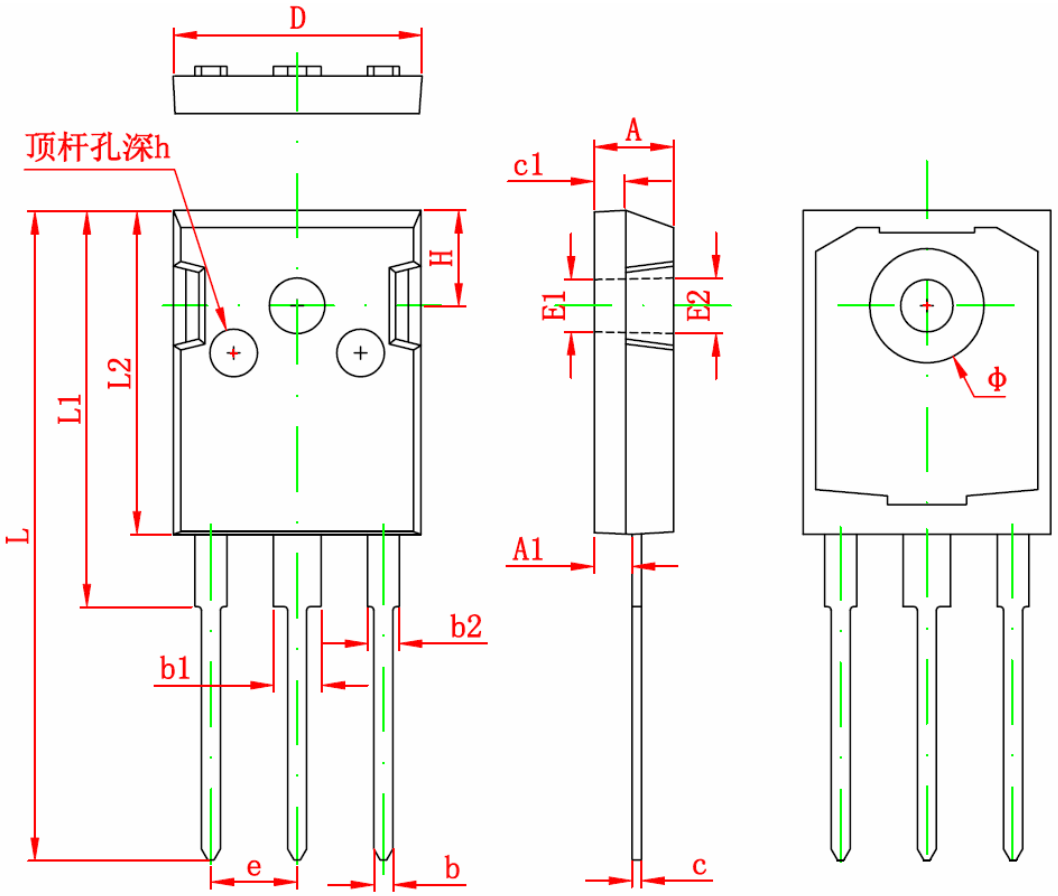



**Figure 11 Normalized Maximum Transient Thermal Impedance**

## TO-247 Package Information




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 4.850 | 5.150 | 0.191 | 0.200 |
| A1 | 2.200 | 2.600 | 0.087 | 0.102 |
| b | 1.000 | 1.400 | 0.039 | 0.055 |
| b1 | 2.800 | 3.200 | 0.110 | 0.126 |
| b2 | 1.800 | 2.200 | 0.071 | 0.087 |
| c | 0.500 | 0.700 | 0.020 | 0.028 |
| c1 | 1.900 | 2.100 | 0.075 | 0.083 |
| D | 15.450 | 15.750 | 0.608 | 0.620 |
| E1 | 3.500REF | | 0.138REF | |
| E2 | 3.600REF | | 0.142REF | |
| L | 40.900 | 41.300 | 1.610 | 1.626 |
| L1 | 24.800 | 25.100 | 0.976 | 0.988 |
| L2 | 20.300 | 20.600 | 0.799 | 0.811 |
| Φ | 7.100 | 7.300 | 0.280 | 0.287 |
| e | 5.450TYP | | 0.215TYP | |
| H | 5.980TYP | | 0.235 REF | |
| h | 0.000 | 0.300 | 0.000 | 0.012 |

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