

## NCE N-Channel Enhancement Mode Power MOSFET

### Description

The NCE80H11H uses advanced trench technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. It can be used in a wide variety of applications.

### General Features

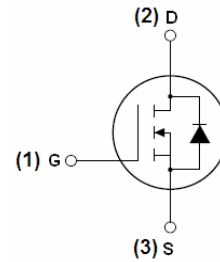
- $V_{DS} = 80V, I_D = 105A$   
 $R_{DS(ON)} < 6.5m\Omega @ V_{GS}=10V$  (Typ:5.8m $\Omega$ )
- High density cell design for ultra low  $R_{DS(ON)}$
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high  $E_{AS}$
- Excellent package for good heat dissipation
- Special process technology for high ESD capability

### Application

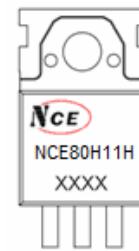
- Automotive applications
- Hard switched and high frequency circuits
- Uninterruptible power supply

**100% UIS TESTED!**

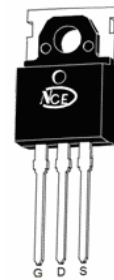
**100%  $\Delta V_{DS}$  TESTED!**



Schematic diagram



Marking and pin assignment



TO-220H-3L top view

### Package Marking and Ordering Information

| Device Marking | Device    | Device Package | Reel Size | Tape width | Quantity |
|----------------|-----------|----------------|-----------|------------|----------|
| NCE80H11H      | NCE80H11H | TO-220H-3L     | -         | -          | -        |

### Absolute Maximum Ratings ( $T_C=25^{\circ}C$ unless otherwise noted)

| Parameter  | Symbol              | Limit      | Unit           |
|--|---------------------|------------|----------------|
| Drain-Source Voltage                             | $V_{DS}$            | 80         | V              |
| Gate-Source Voltage                              | $V_{GS}$            | $\pm 20$   | V              |
| Drain Current-Continuous                         | $I_D$               | 105        | A              |
| Drain Current-Continuous( $T_C=100^{\circ}C$ )   | $I_D(100^{\circ}C)$ | 74         | A              |
| Pulsed Drain Current                             | $I_{DM}$            | 420        | A              |
| Maximum Power Dissipation                        | $P_D$               | 200        | W              |
| Derating factor                                  |                     | 1.33       | W/ $^{\circ}C$ |
| Single pulse avalanche energy (Note 5)           | $E_{AS}$            | 800        | mJ             |
| Operating Junction and Storage Temperature Range | $T_J, T_{STG}$      | -55 To 175 | $^{\circ}C$    |

## Thermal Characteristic

|  |                 |      |                      |
|--|-----------------|------|----------------------|
| Thermal Resistance, Junction-to-Case <sup>(Note 2)</sup> | $R_{\theta JC}$ | 0.75 | $^{\circ}\text{C/W}$ |
|--|-----------------|------|----------------------|

## Electrical Characteristics ( $T_C=25^{\circ}\text{C}$ unless otherwise noted)

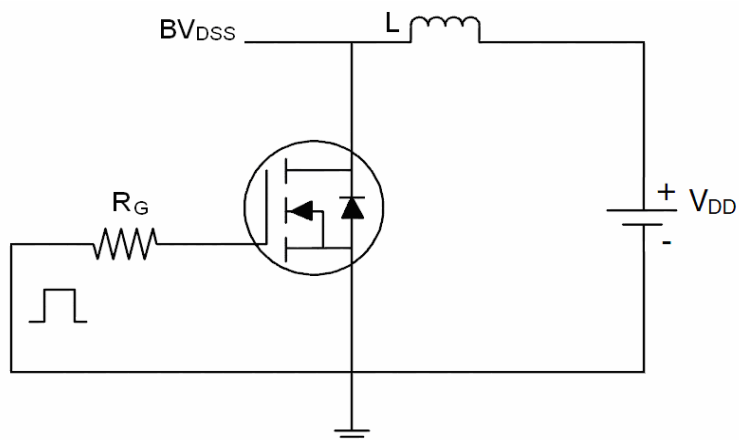
| Parameter                                     | Symbol              | Condition  | Min | Typ  | Max  | Unit |
|---|---------------------|--|-----|------|------|------|
| Off Characteristics                           |                     |  |     |      |      |      |
| Drain-Source Breakdown Voltage                | BV <sub>DSS</sub>   | V <sub>GS</sub> =0V I <sub>D</sub> =250μA                            | 80  | 86   | -    | V    |
| Zero Gate Voltage Drain Current               | I <sub>DSS</sub>    | V <sub>DS</sub> =80V, V <sub>GS</sub> =0V                            | -   | -    | 1    | μA   |
| Gate-Body Leakage Current                     | I <sub>GSS</sub>    | V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V                           | -   | -    | ±100 | nA   |
| On Characteristics <sup>(Note 3)</sup>        |                     |  |     |      |      |      |
| Gate Threshold Voltage                        | V <sub>GS(th)</sub> | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA             | 2   | 3    | 4    | V    |
| Drain-Source On-State Resistance              | R <sub>DS(ON)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =40A                            | -   | 5.8  | 6.5  | mΩ   |
| Forward Transconductance                      | g <sub>FS</sub>     | V <sub>DS</sub> =25V, I <sub>D</sub> =40A                            | 80  | -    | -    | S    |
| Dynamic Characteristics <sup>(Note4)</sup>    |                     |  |     |      |      |      |
| Input Capacitance                             | C <sub>iss</sub>    | V <sub>DS</sub> =25V, V <sub>GS</sub> =0V,<br>F=1.0MHz               | -   | 4900 | -    | PF   |
| Output Capacitance                            | C <sub>oss</sub>    |  | -   | 410  | -    | PF   |
| Reverse Transfer Capacitance                  | C <sub>rss</sub>    |  | -   | 315  | -    | PF   |
| Switching Characteristics <sup>(Note 4)</sup> |                     |  |     |      |      |      |
| Turn-on Delay Time                            | t <sub>d(on)</sub>  | VDD=40V, ID=2A, RL=15Ω,<br>RG=2.5Ω, VGS=10V                          | -   | 20   | -    | nS   |
| Turn-on Rise Time                             | t <sub>r</sub>      |  | -   | 19   | -    | nS   |
| Turn-Off Delay Time                           | t <sub>d(off)</sub> |  | -   | 70   | -    | nS   |
| Turn-Off Fall Time                            | t <sub>f</sub>      |  | -   | 30   | -    | nS   |
| Total Gate Charge                             | Q <sub>g</sub>      | ID=30A, VDD=30V, VGS=10V   | -   | 125  | -    | nC   |
| Gate-Source Charge                            | Q <sub>gs</sub>     |  | -   | 24   | -    | nC   |
| Gate-Drain Charge                             | Q <sub>gd</sub>     |  | -   | 49   | -    | nC   |
| Drain-Source Diode Characteristics            |                     |  |     |      |      |      |
| Diode Forward Voltage <sup>(Note 3)</sup>     | V <sub>SD</sub>     | V <sub>GS</sub> =0V, I <sub>S</sub> =40A                             | -   | -    | 1.2  | V    |
| Diode Forward Current <sup>(Note 2)</sup>     | I <sub>S</sub>      |  | -   | -    | 105  | A    |
| Reverse Recovery Time                         | t <sub>rr</sub>     | Tj=25℃, IF=75A,<br>di/dt=100A/uS <sup>(Note3)</sup>                  | -   | 37   |      | nS   |
| Reverse Recovery Charge                       | Q <sub>rr</sub>     |  | -   | 58   |      | nC   |
| Forward Turn-On Time                          | t <sub>on</sub>     | Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD) |     |      |      |      |

## Notes:

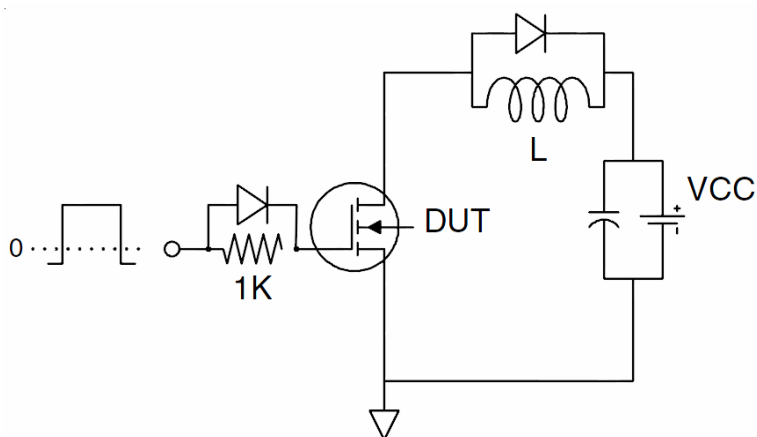
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production
5. EAS condition:  $T_j=25^{\circ}\text{C}, V_{DD}=40V, V_G=10V, L=0.5\text{mH}, R_g=25\Omega$

## Test circuit

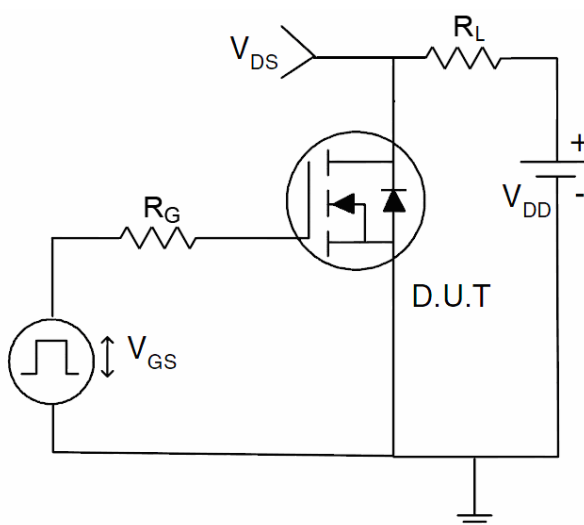
### 1) $E_{AS}$ test Circuit



### 2) Gate charge test Circuit



### 3) Switch Time Test Circuit



## Typical Electrical and Thermal Characteristics (Curves)

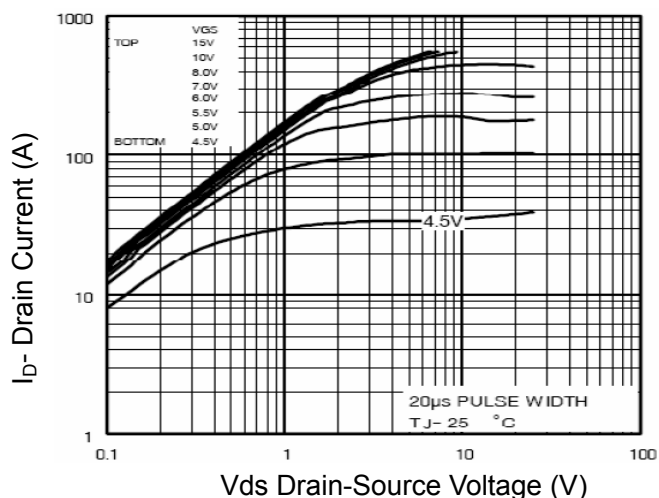


Figure 1 Output Characteristics

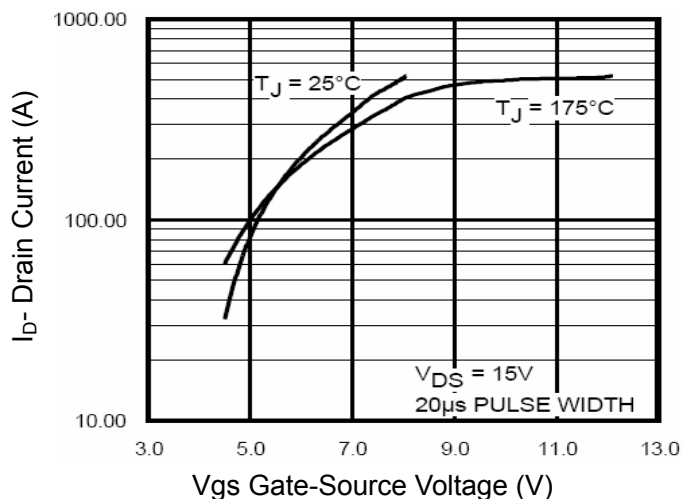


Figure 2 Transfer Characteristics

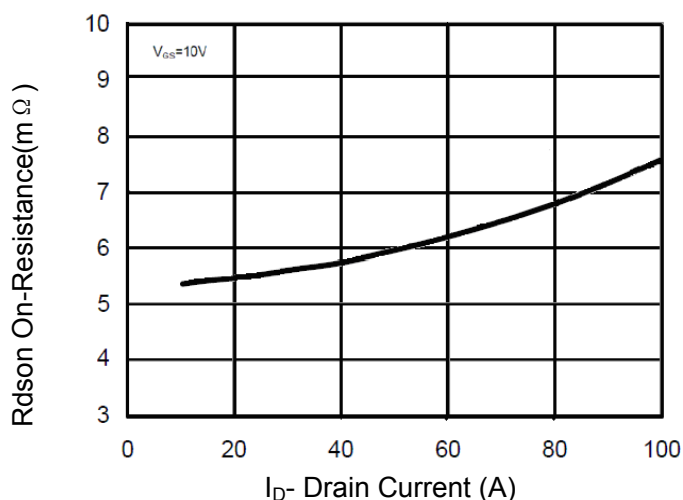


Figure 3 Rdson- Drain Current

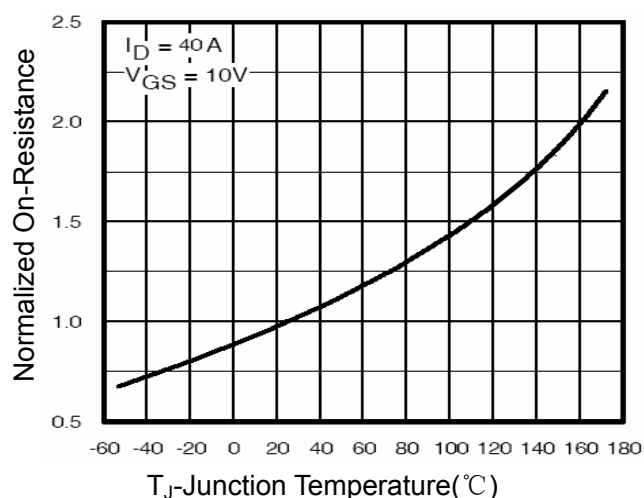


Figure 4 Rdson-Junction Temperature

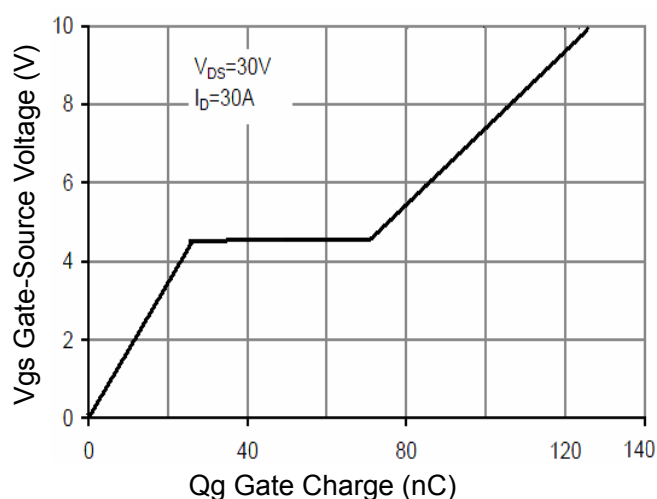


Figure 5 Gate Charge

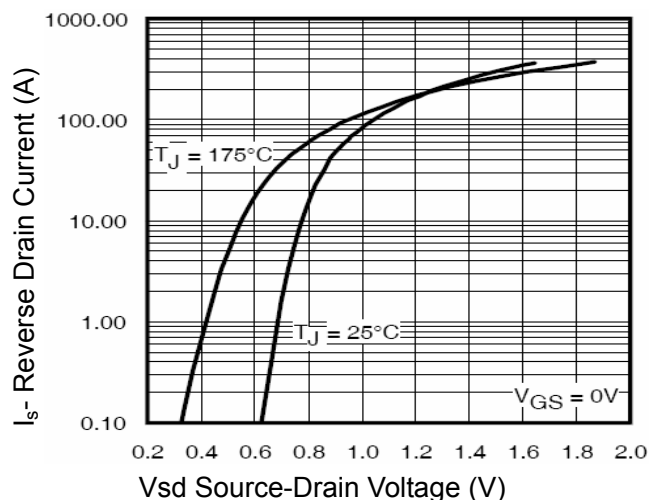


Figure 6 Source- Drain Diode Forward

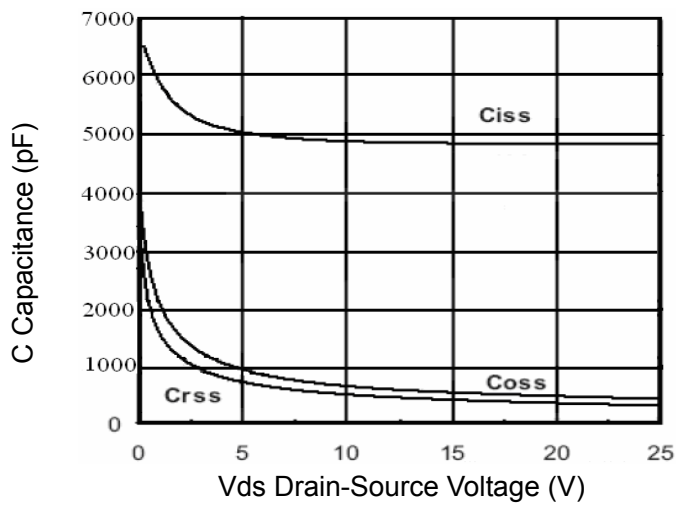


Figure 7 Capacitance vs Vds

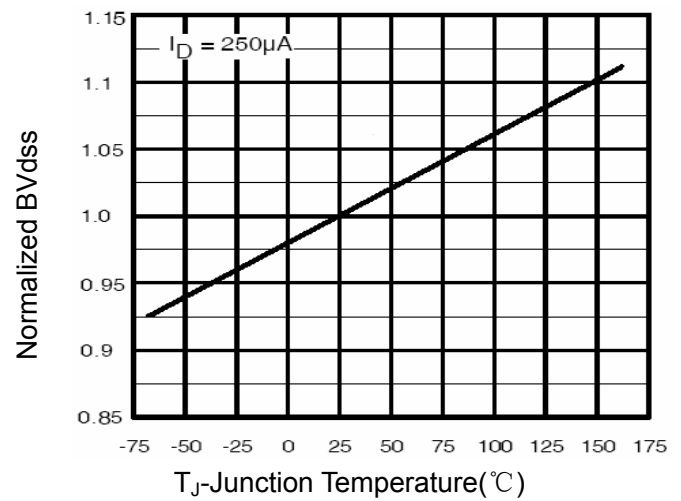


Figure 9 BV<sub>DSS</sub> vs Junction Temperature

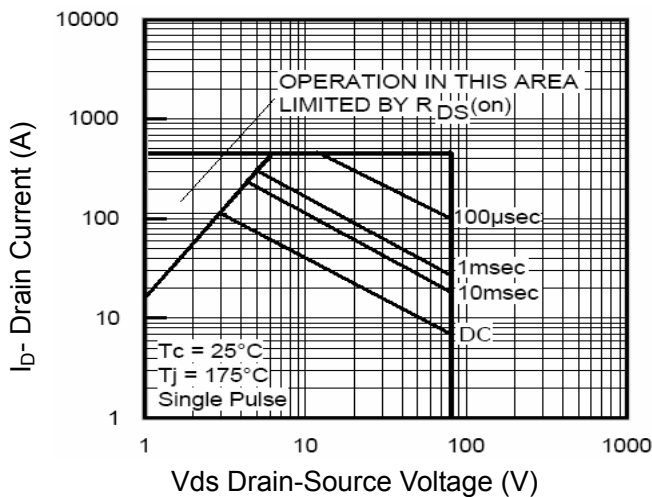


Figure 8 Safe Operation Area

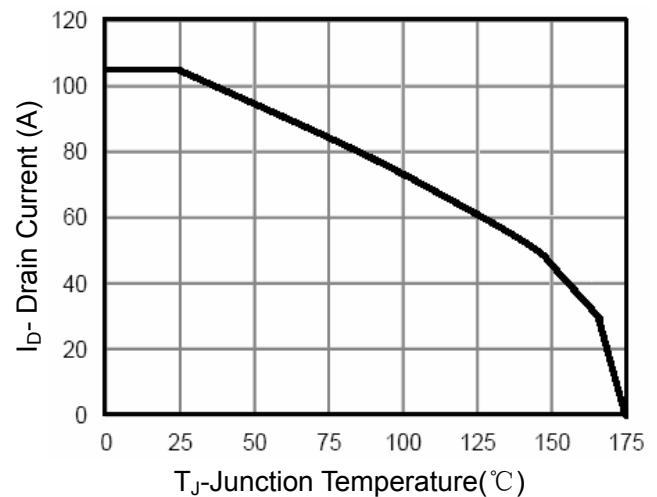


Figure 10 Current vs Junction Temperature

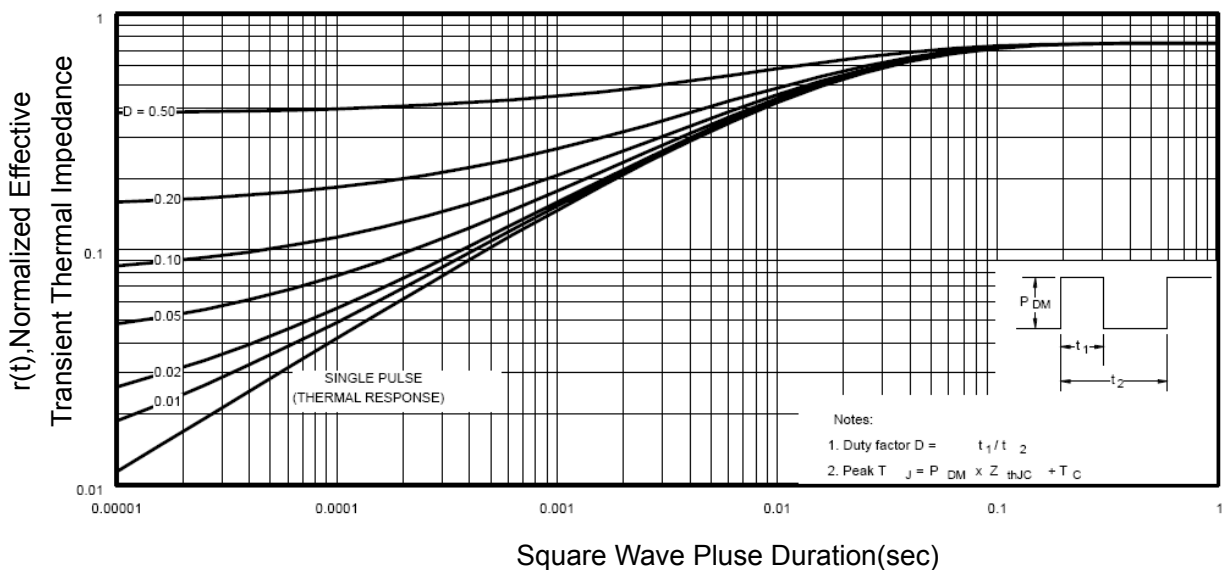
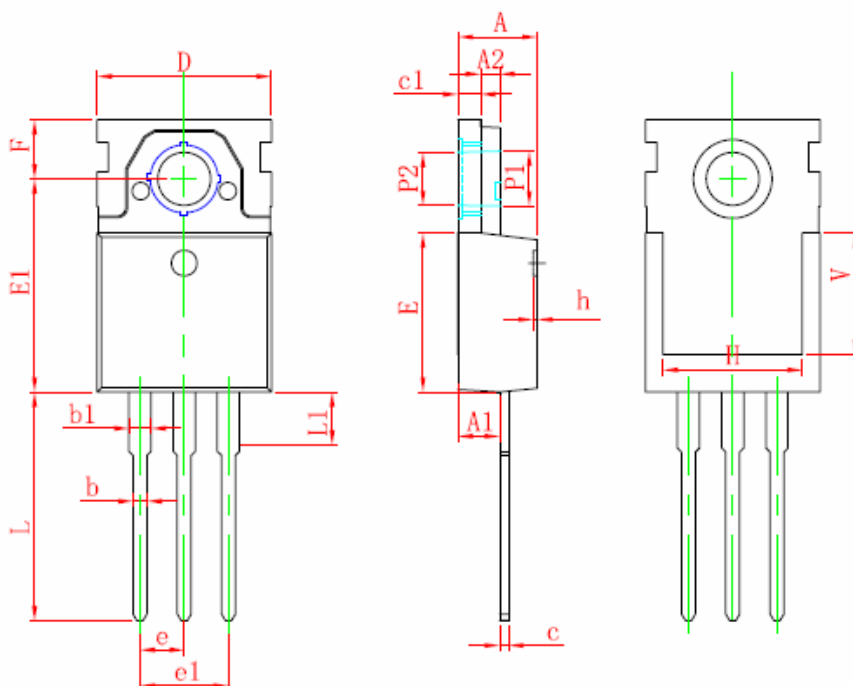


Figure 11 Normalized Maximum Transient Thermal Impedance

## TO-220H-3L Package Information



| Symbol | Dimensions In Millimeters |        | Dimensions In Inches |       |
|--------|---------------------------|--------|----------------------|-------|
|        | Min.                      | Max.   | Min.                 | Max.  |
| A      | 4.400                     | 4.600  | 0.173                | 0.181 |
| A1     | 2.250                     | 2.550  | 0.089                | 0.100 |
| A2     | 1.000                     | 1.200  | 0.039                | 0.047 |
| b      | 0.710                     | 0.910  | 0.028                | 0.036 |
| b1     | 1.170                     | 1.370  | 0.046                | 0.054 |
| c      | 0.330                     | 0.650  | 0.013                | 0.026 |
| c1     | 1.200                     | 1.400  | 0.047                | 0.055 |
| D      | 9.820                     | 10.220 | 0.387                | 0.402 |
| E      | 8.950                     | 9.350  | 0.352                | 0.368 |
| E1     | 12.000                    | 12.500 | 0.472                | 0.492 |
| e      | 2.540 TYP.                |        | 0.100 TYP.           |       |
| e1     | 4.980                     | 5.180  | 0.196                | 0.204 |
| F      | 3.250                     | 3.550  | 0.128                | 0.140 |
| H      | 7.900                     | 8.100  | 0.311                | 0.319 |
| h      | 0.000                     | 0.300  | 0.000                | 0.012 |
| L      | 12.930                    | 13.330 | 0.509                | 0.525 |
| L1     | 3.450                     | 3.850  | 0.136                | 0.152 |
| P1     | 3.15 TYP.                 |        | 0.124 TYP.           |       |
| P2     | 3.05 TYP.                 |        | 0.120 TYP.           |       |
| V      | 6.900 REF.                |        | 0.272 REF.           |       |

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