

**80V(D-S) N-Channel Enhancement Mode Power MOS FET**

**General Features**

- $V_{DS} = 80V, I_D = 120A$   
 $R_{DS(ON)} < 6m\Omega @ V_{GS} = 10V$
- High density cell design for ultra low  $R_{dson}$
- 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



**Lead Free**

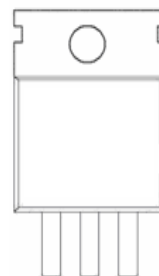
**Application**

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

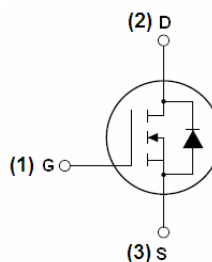
**PIN Configuration**



TO-220-3L top view



Marking and pin assignment



Schematic diagram

**Package Marking and Ordering Information**

| Device Marking | Device   | Device Package | Reel Size | Tape width | Quantity |
|----------------|----------|----------------|-----------|------------|----------|
| MSN08B2K       | MSN08B2K | TO-220-3L      | -         | -          | -        |

**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                          | $I_D$              | 120        | A             |
| Drain Current-Continuous( $T_C = 100^\circ C$ )   | $I_D(100^\circ C)$ | 84         | A             |
| Pulsed Drain Current                              | $I_{DM}$           | 450        | A             |
| Maximum Power Dissipation                         | $P_D$              | 220        | W             |
| Derating factor                                   |                    | 1.47       | W/ $^\circ C$ |
| Single pulse avalanche energy <sup>(Note 5)</sup> | $E_{AS}$           | 1400       | 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> | $R_{\theta JC}$ | 0.68 | °C/W |
|----------------------------------------------------------|-----------------|------|------|

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

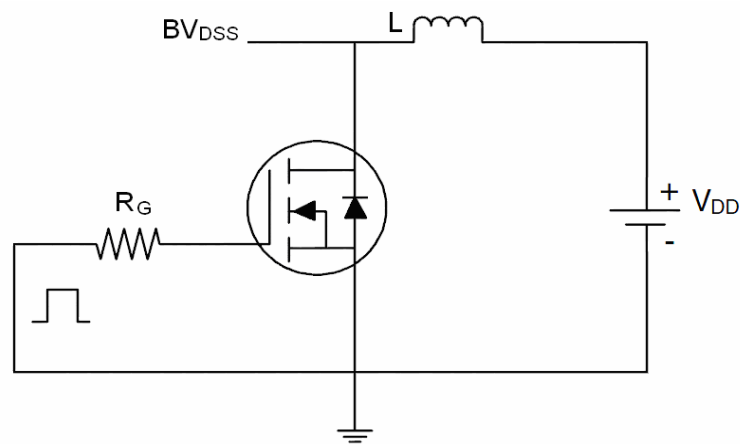
| Parameter                                     | Symbol              | Condition                                                                            | Min | Typ  | Max  | Unit |
|-----------------------------------------------|---------------------|--------------------------------------------------------------------------------------|-----|------|------|------|
| Off Characteristics                           |                     |                                                                                      |     |      |      |      |
| Drain-Source Breakdown Voltage                | BV <sub>DSS</sub>   | V <sub>GS</sub> =0V I <sub>D</sub> =250μA                                            | 80  | 89   | -    | 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                                            | -   | 4.9  | 6    | mΩ   |
| Forward Transconductance                      | g <sub>FS</sub>     | V <sub>DS</sub> =25V,I <sub>D</sub> =5A                                              | 90  | -    | -    | 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                                | -   | 6500 | -    | PF   |
| Output Capacitance                            | C <sub>OSS</sub>    |                                                                                      | -   | 520  | -    | PF   |
| Reverse Transfer Capacitance                  | C <sub>RSS</sub>    |                                                                                      | -   | 460  | -    | PF   |
| Switching Characteristics <sup>(Note 4)</sup> |                     |                                                                                      |     |      |      |      |
| Turn-on Delay Time                            | t <sub>d(on)</sub>  | V <sub>DD</sub> =30V,I <sub>D</sub> =2A<br>V <sub>GS</sub> =10V,R <sub>G</sub> =2.5Ω | -   | 26   | -    | nS   |
| Turn-on Rise Time                             | t <sub>r</sub>      |                                                                                      | -   | 24   | -    | nS   |
| Turn-Off Delay Time                           | t <sub>d(off)</sub> |                                                                                      | -   | 91   | -    | nS   |
| Turn-Off Fall Time                            | t <sub>f</sub>      |                                                                                      | -   | 39   | -    | nS   |
| Total Gate Charge                             | Q <sub>g</sub>      | V <sub>DS</sub> =30V,I <sub>D</sub> =30A,<br>V <sub>GS</sub> =10V                    | -   | 163  |      | nC   |
| Gate-Source Charge                            | Q <sub>gs</sub>     |                                                                                      | -   | 31   |      | nC   |
| Gate-Drain Charge                             | Q <sub>gd</sub>     |                                                                                      | -   | 64   |      | 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>      |                                                                                      | -   | -    | 120  | A    |
| Reverse Recovery Time                         | t <sub>rr</sub>     | TJ = 25°C, IF = 40A<br>di/dt = 100A/μs <sup>(Note3)</sup>                            | -   | 42   | 60   | nS   |
| Reverse Recovery Charge                       | Q <sub>rr</sub>     |                                                                                      | -   | 66   | 80   | nC   |
| Forward Turn-On Time                          | t <sub>on</sub>     | Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)                 |     |      |      |      |

### Notes:

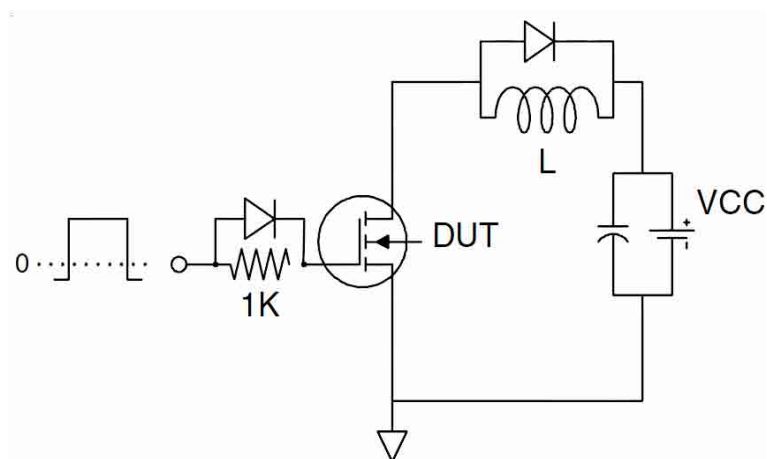
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production
5. EAS condition:  $T_J=25^{\circ}\text{C}, V_{DD}=40V,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

## Test circuit

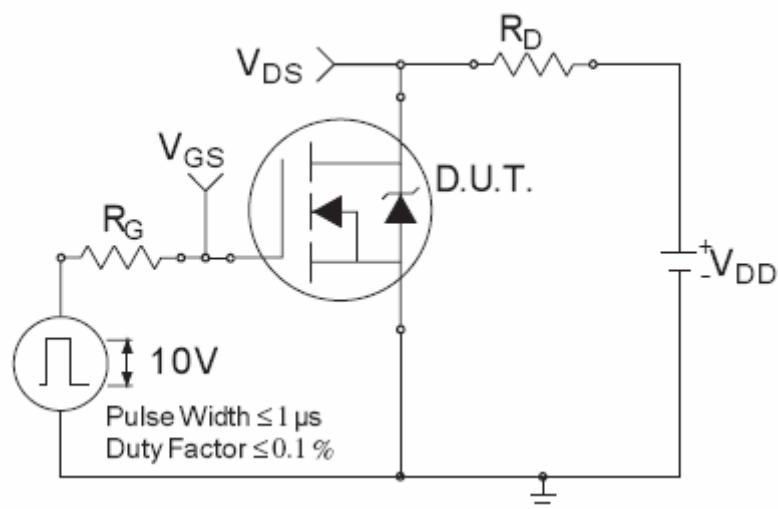
### 1) $E_{AS}$ test Circuit



### 2) Gate charge test Circuit



### 3) Switch Time Test Circuit



# Typical Electrical and Thermal Characteristics (Curves)

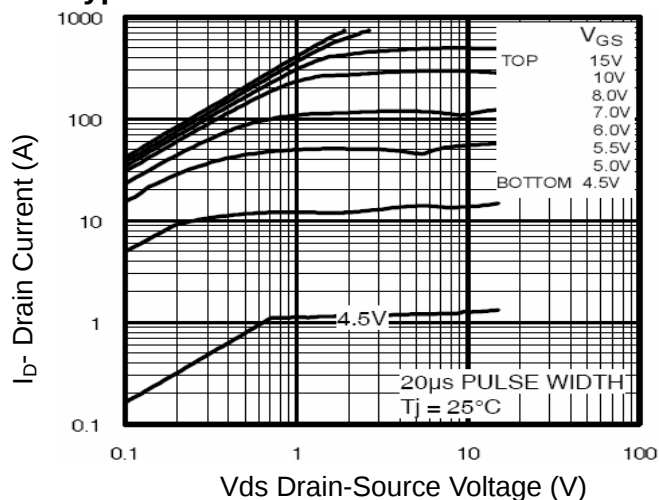


Figure 1 Output Characteristics

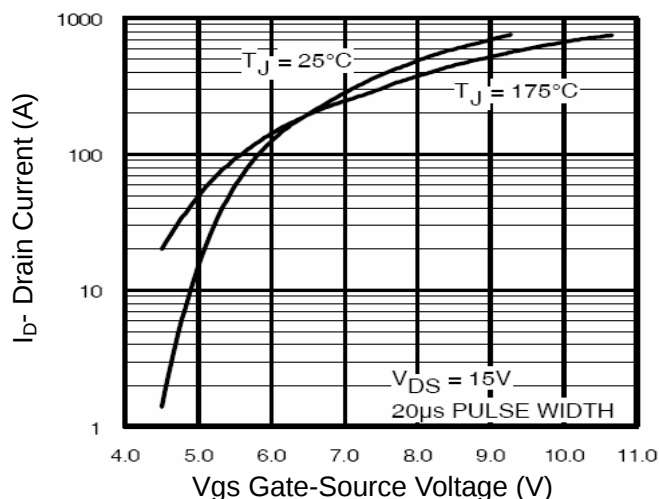


Figure 2 Transfer Characteristics

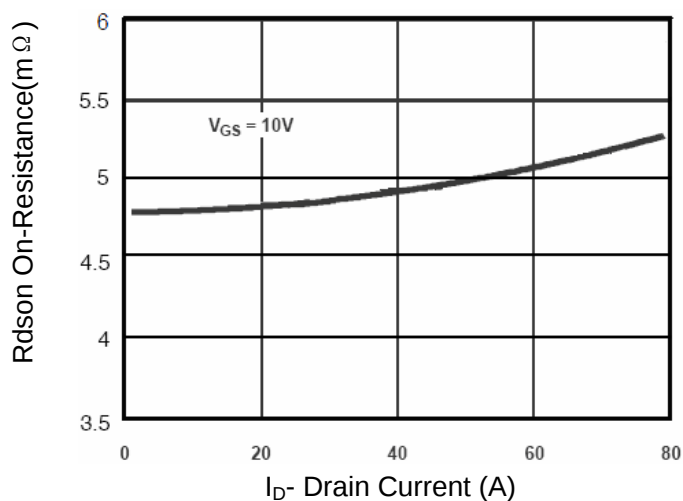


Figure 3  $R_{DS(on)}$ - Drain Current

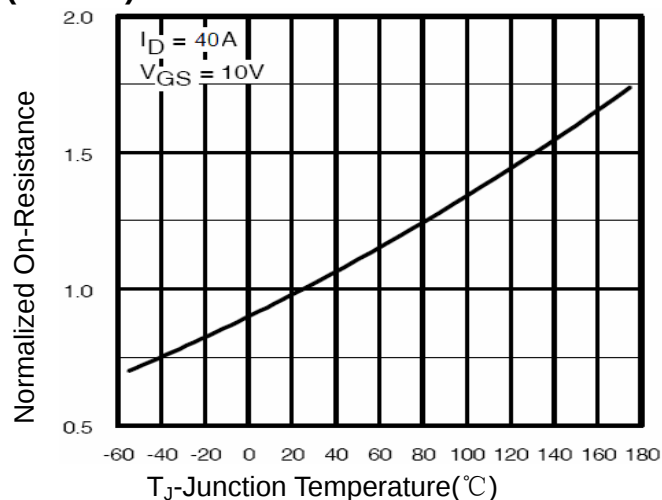


Figure 4  $R_{DS(on)}$ -Junction Temperature

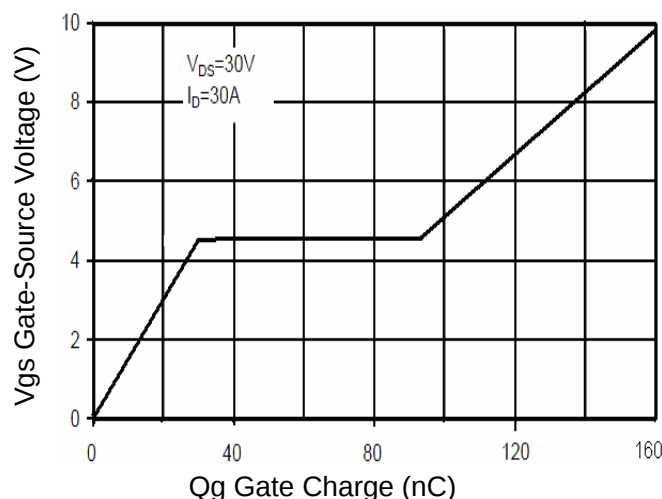


Figure 5 Gate Charge

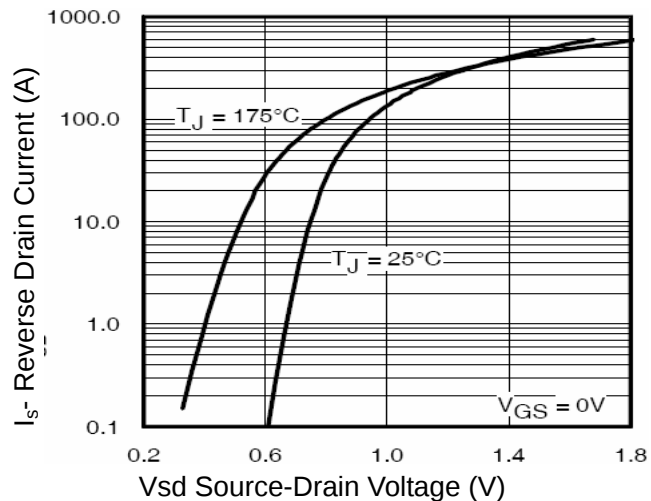


Figure 6 Source- Drain Diode Forward

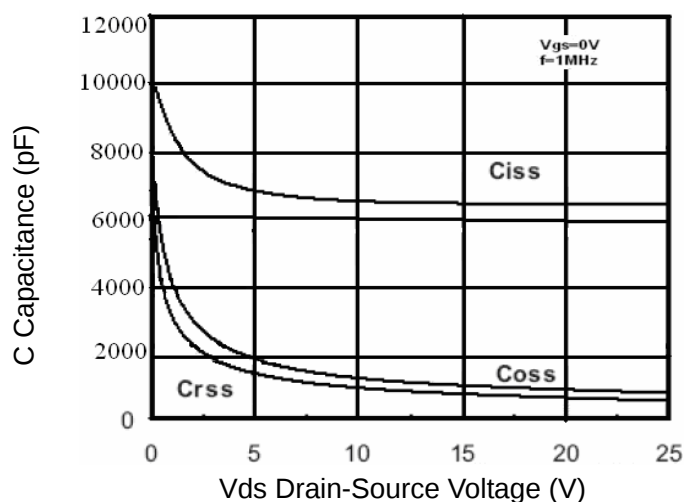


Figure 7 Capacitance vs Vds

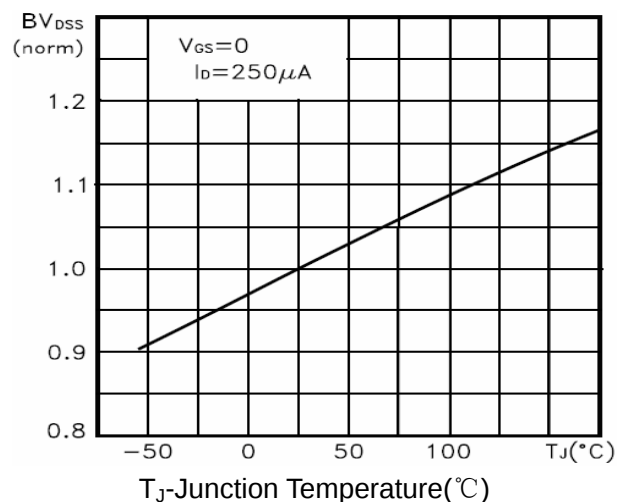


Figure 9 BV<sub>DSS</sub> vs Junction Temperature

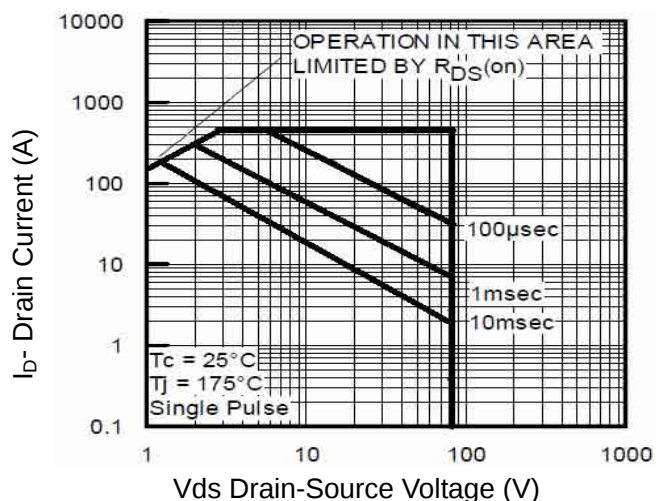


Figure 8 Safe Operation Area

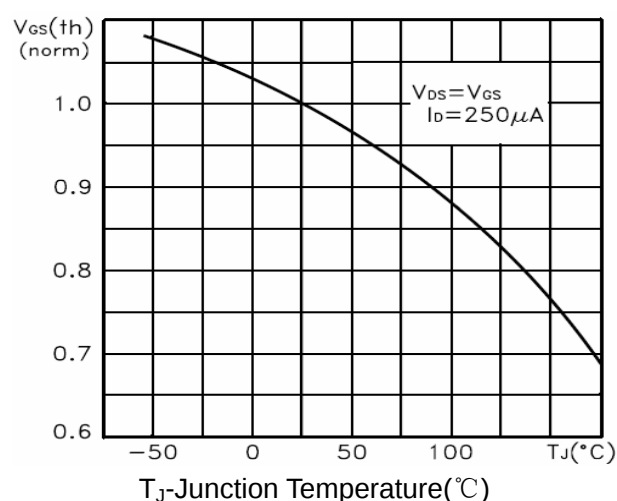


Figure 10 V<sub>GS(th)</sub> vs Junction Temperature

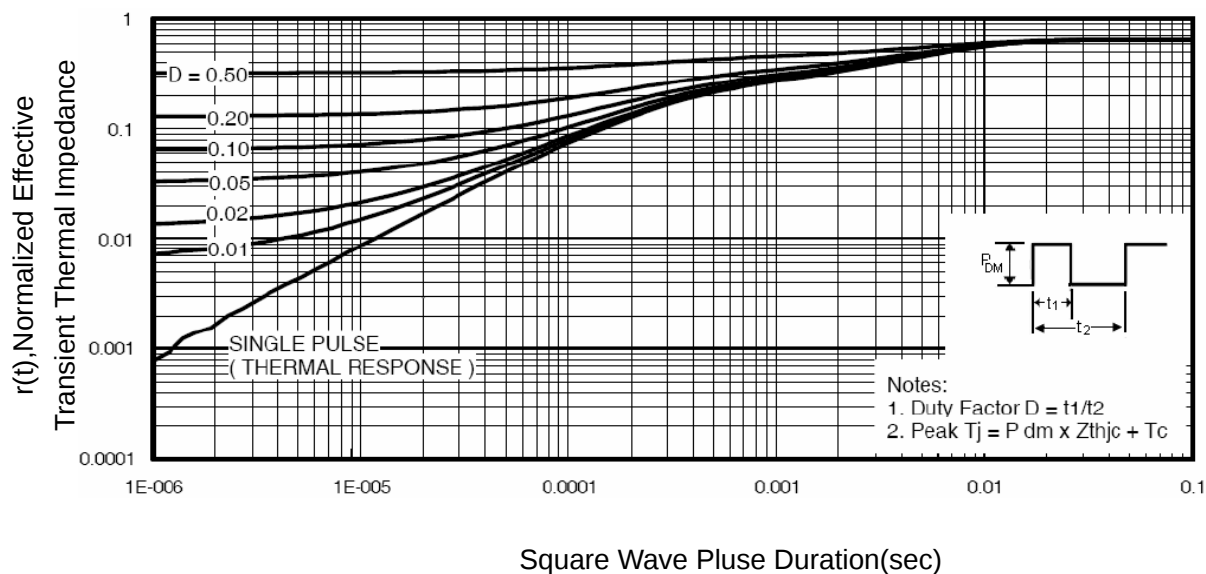
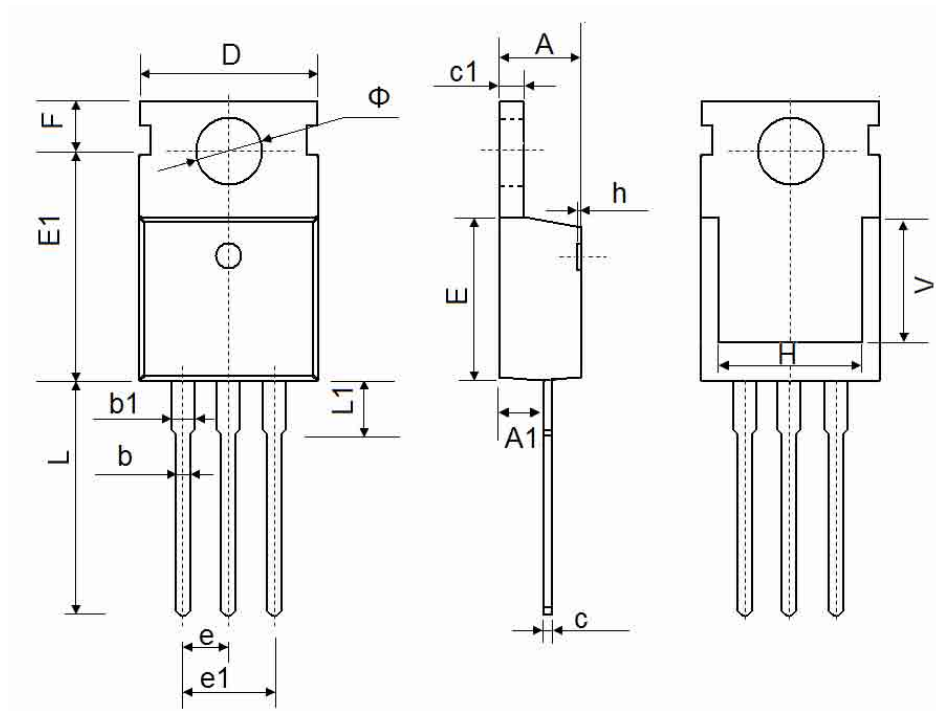


Figure 11 Normalized Maximum Transient Thermal Impedance

## TO-220-3L 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 |
| 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      | 9.910                     | 10.250 | 0.390                | 0.404 |
| E      | 8.9500                    | 9.750  | 0.352                | 0.384 |
| E1     | 12.650                    | 12.950 | 0.498                | 0.510 |
| e      | 2.540 TYP.                |        | 0.100 TYP.           |       |
| 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      | 12.900                    | 13.400 | 0.508                | 0.528 |
| L1     | 2.850                     | 3.250  | 0.112                | 0.128 |
| V      | 7.500 REF.                |        | 0.295 REF.           |       |
| Φ      | 3.400                     | 3.800  | 0.134                | 0.150 |