

# 150V(D-S) N-Channel Enhancement Mode Power MOS FET

## General Features

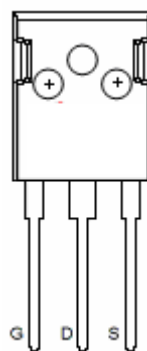
- $V_{DS} = 150V, I_D = 150A$   
 $R_{DS(ON)} < 8m\Omega @ V_{GS}=10V$  (Typ: 6.6 m $\Omega$ )
- Good stability and uniformity with high  $E_{AS}$
- Special process technology for high ESD capability
- High density cell design for ultra low  $R_{dson}$
- Fully characterized avalanche voltage and current
- Excellent package for good heat dissipation



**Lead Free**

## Application

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

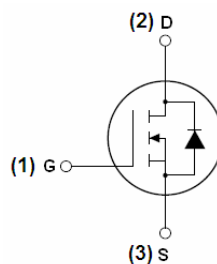


Marking and pin assignment

## PIN Configuration



TO-247 top view



Schematic diagram

## Package Marking and Ordering Information

| Device Marking | Device   | Device Package | Reel Size | Tape width | Quantity |
|----------------|----------|----------------|-----------|------------|----------|
| MSN15B5H       | MSN15B5H | TO-247         | -         | -          | -        |

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

| Parameter                                         | Symbol              | Limit      | Unit           |
|---------------------------------------------------|---------------------|------------|----------------|
| Drain-Source Voltage                              | $V_{DS}$            | 150        | V              |
| Gate-Source Voltage                               | $V_{GS}$            | $\pm 20$   | V              |
| Drain Current-Continuous                          | $I_D$               | 150        | A              |
| Drain Current-Continuous( $T_C=100^{\circ}C$ )    | $I_D(100^{\circ}C)$ | 106        | A              |
| Pulsed Drain Current                              | $I_{DM}$            | 600        | A              |
| Maximum Power Dissipation                         | $P_D$               | 460        | W              |
| Derating factor                                   |                     | 3.07       | W/ $^{\circ}C$ |
| Single pulse avalanche energy <sup>(Note 3)</sup> | $E_{AS}$            | 3100       | mJ             |
| Peak Diode Recovery $dv/dt$ <sup>(Note 4)</sup>   | $dv/dt$             | 18.5       | V/ns           |
| Operating Junction and Storage Temperature Range  | $T_J, T_{STG}$      | -55 To 175 | $^{\circ}C$    |

## Thermal Characteristic

|                                                          |                 |      |                      |
|----------------------------------------------------------|-----------------|------|----------------------|
| Thermal Resistance, Junction-to-Case <sup>(Note 1)</sup> | $R_{\theta JC}$ | 0.33 | $^{\circ}\text{C/W}$ |
|----------------------------------------------------------|-----------------|------|----------------------|

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

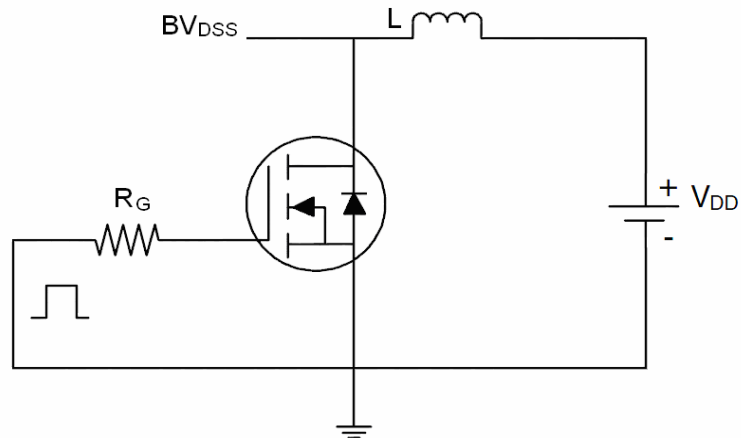
| Parameter                          | Symbol              | Condition                                                                                                   | Min | Typ   | Max  | Unit |
|------------------------------------|---------------------|-------------------------------------------------------------------------------------------------------------|-----|-------|------|------|
| Off Characteristics                |                     |                                                                                                             |     |       |      |      |
| Drain-Source Breakdown Voltage     | BV <sub>DSS</sub>   | V <sub>GS</sub> =0V I <sub>D</sub> =250μA                                                                   | 150 | 170   | -    | V    |
| Zero Gate Voltage Drain Current    | I <sub>DSS</sub>    | V <sub>DS</sub> =150V, 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                                                                  | -   | -     | ±200 | nA   |
| On Characteristics                 |                     |                                                                                                             |     |       |      |      |
| 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                                                                   | -   | 6.6   | 8    | mΩ   |
| Forward Transconductance           | g <sub>FS</sub>     | V <sub>DS</sub> =50V, I <sub>D</sub> =40A                                                                   | 150 | -     | -    | S    |
| Dynamic Characteristics            |                     |                                                                                                             |     |       |      |      |
| Input Capacitance                  | C <sub>iss</sub>    | V <sub>DS</sub> =25V, V <sub>GS</sub> =0V,<br>F=1.0MHz                                                      | -   | 21000 | -    | PF   |
| Output Capacitance                 | C <sub>oss</sub>    |                                                                                                             | -   | 1446  | -    | PF   |
| Reverse Transfer Capacitance       | C <sub>rss</sub>    |                                                                                                             | -   | 1120  | -    | PF   |
| Switching Characteristics          |                     |                                                                                                             |     |       |      |      |
| Turn-on Delay Time                 | t <sub>d(on)</sub>  | V <sub>DD</sub> =30V, I <sub>D</sub> =2A, R <sub>L</sub> =15Ω<br>V <sub>GS</sub> =10V, R <sub>G</sub> =2.5Ω | -   | 20    | -    | nS   |
| Turn-on Rise Time                  | t <sub>r</sub>      |                                                                                                             | -   | 110   | -    | nS   |
| Turn-Off Delay Time                | t <sub>d(off)</sub> |                                                                                                             | -   | 45    | -    | nS   |
| Turn-Off Fall Time                 | t <sub>f</sub>      |                                                                                                             | -   | 70    | -    | nS   |
| Total Gate Charge                  | Q <sub>g</sub>      | V <sub>DS</sub> =30V, I <sub>D</sub> =30A<br>V <sub>GS</sub> =10V                                           | -   | 586   | -    | nC   |
| Gate-Source Charge                 | Q <sub>gs</sub>     |                                                                                                             | -   | 123   | -    | nC   |
| Gate-Drain Charge                  | Q <sub>gd</sub>     |                                                                                                             | -   | 184   | -    | nC   |
| Drain-Source Diode Characteristics |                     |                                                                                                             |     |       |      |      |
| Diode Forward Voltage              | V <sub>SD</sub>     | V <sub>GS</sub> =0V, I <sub>S</sub> =40A                                                                    | -   | -     | 1.2  | V    |
| Reverse Recovery Time              | t <sub>rr</sub>     | T <sub>J</sub> = 25°C, I <sub>F</sub> = 75A<br>di/dt = 100A/μs <sup>(Note2)</sup>                           | -   | 71    | -    | nS   |
| Reverse Recovery Charge            | Q <sub>rr</sub>     |                                                                                                             | -   | 106   | -    | nC   |
| Forward Turn-On Time               | t <sub>on</sub>     | Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)                                        |     |       |      |      |

## Notes:

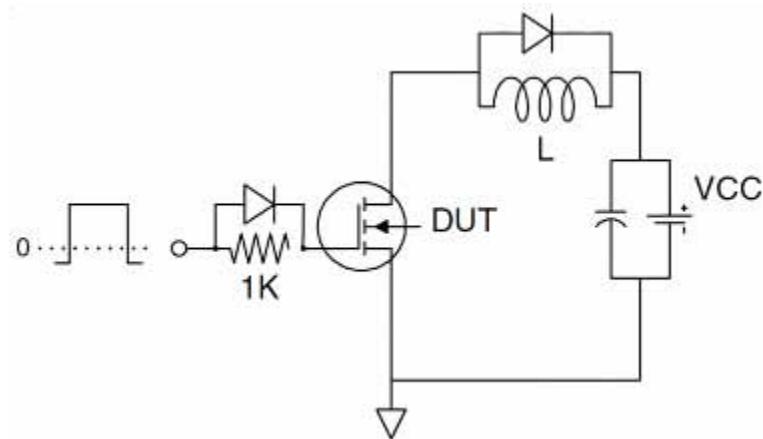
1. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
2. Pulse Test: Pulse Width  $\leq 400\mu s$ , Duty Cycle  $\leq 2\%$ .
3. EAS condition:  $T_J=25^{\circ}\text{C}, V_{DD}=75V, V_G=10V, L=0.5mH, R_G=25\Omega$
4.  $I_{SD} \leq 125A, di/dt \leq 260A/\mu s, V_{DD} \leq V_{(BR)PSS}, T_J \leq 175^{\circ}\text{C}$

## Test circuit

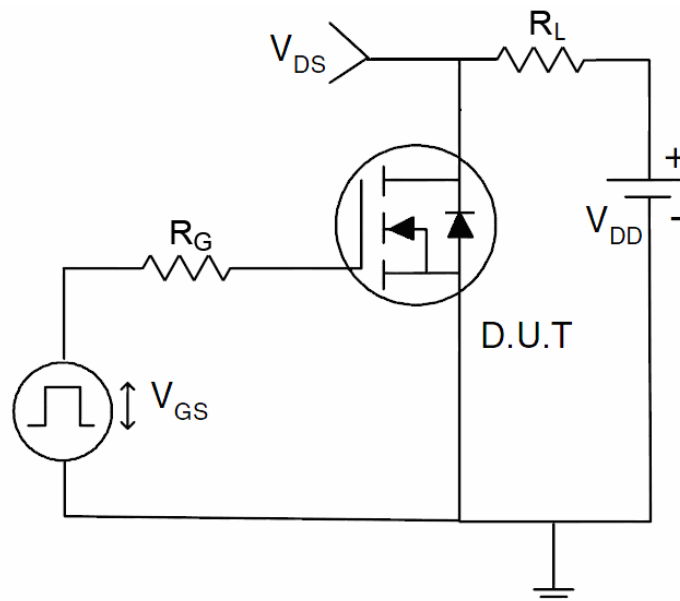
### 1) $E_{AS}$ test Circuits



### 2) Gate charge test Circuit:



### 3) Switch Time Test Circuit:



# Typical Electrical and Thermal Characteristics

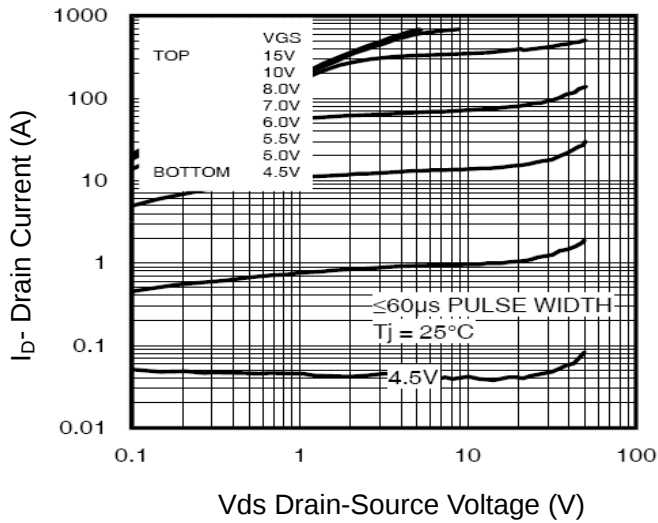


Figure 1 Output Characteristics

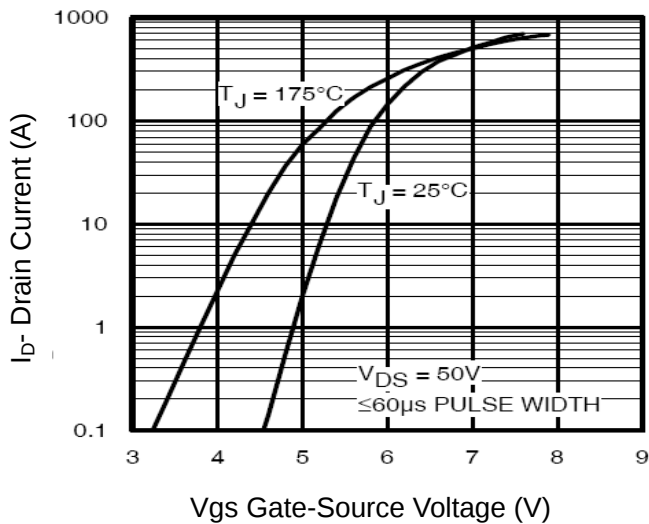


Figure 2 Transfer Characteristics

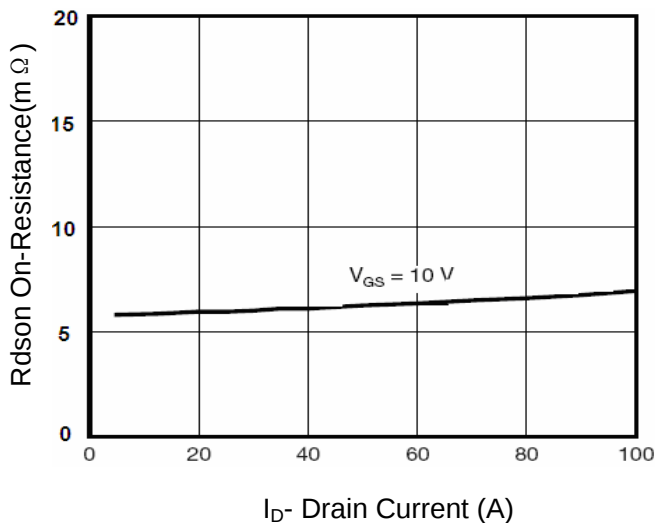


Figure 3  $R_{DS(on)}$ - Drain Current

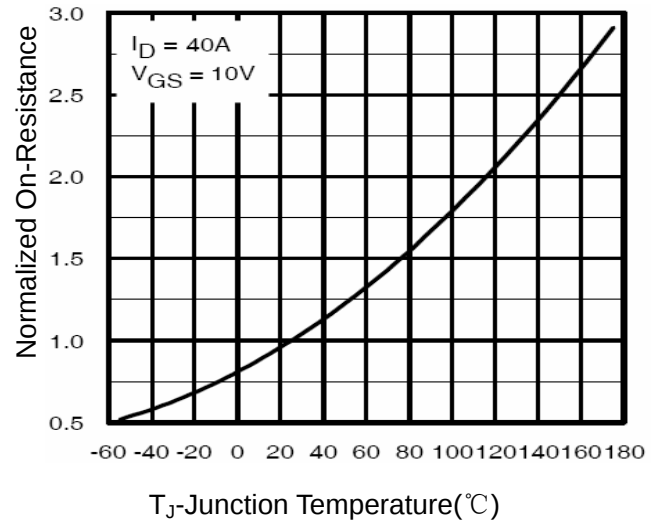


Figure 4  $R_{DS(on)}$ -Junction Temperature

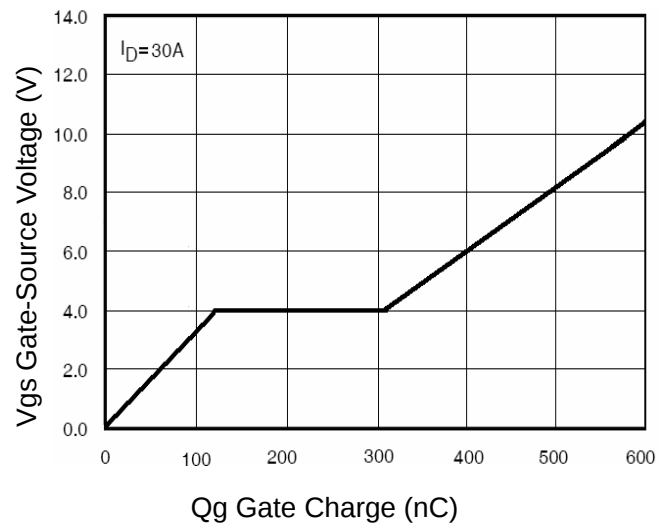


Figure 5 Gate Charge

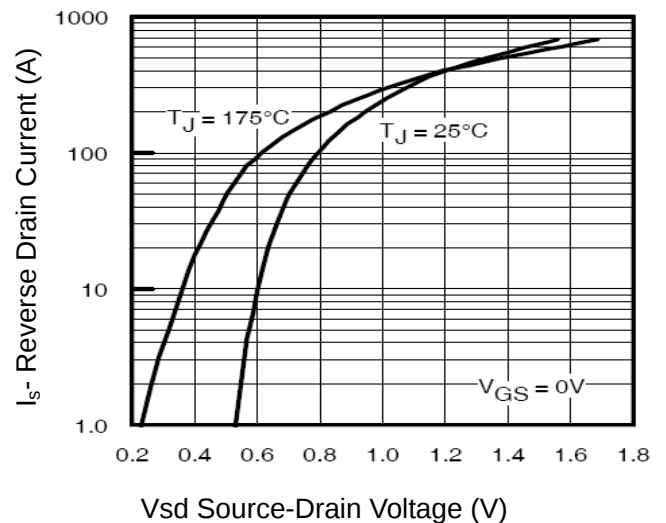
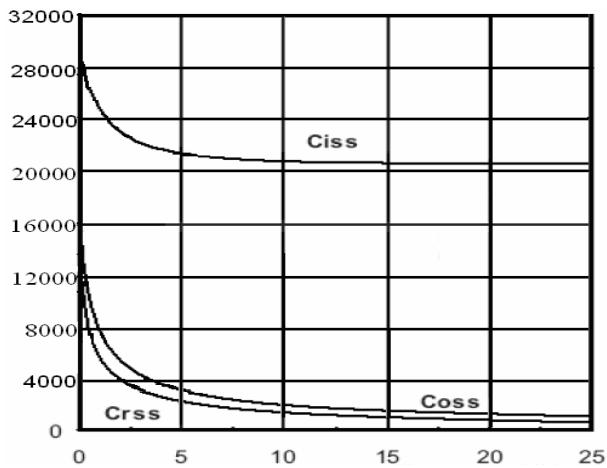
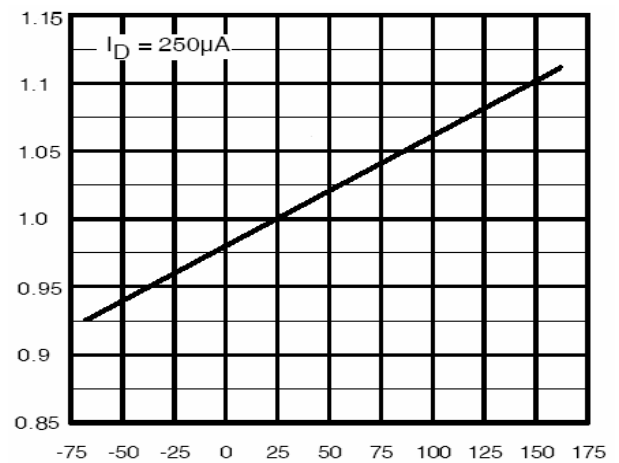


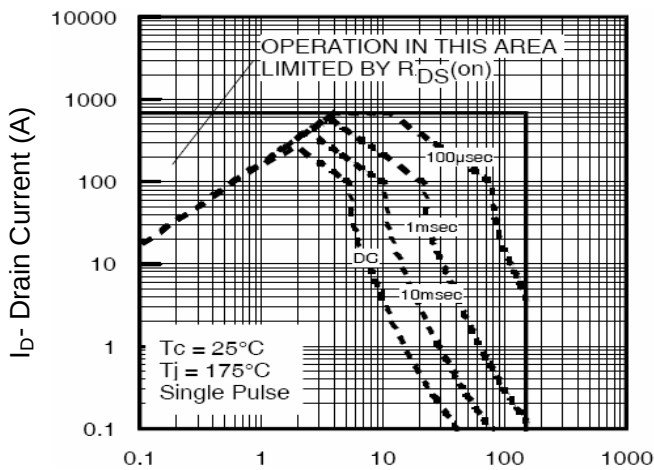
Figure 6 Source- Drain Diode Forward



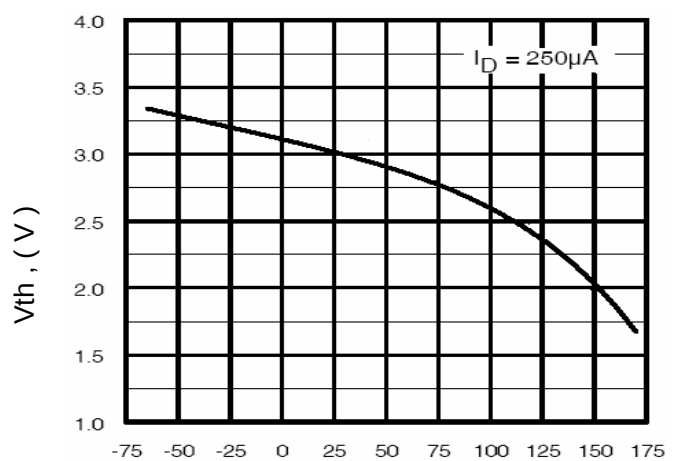
Vds Drain-Source Voltage (V)  
**Figure 7 Capacitance vs Vds**



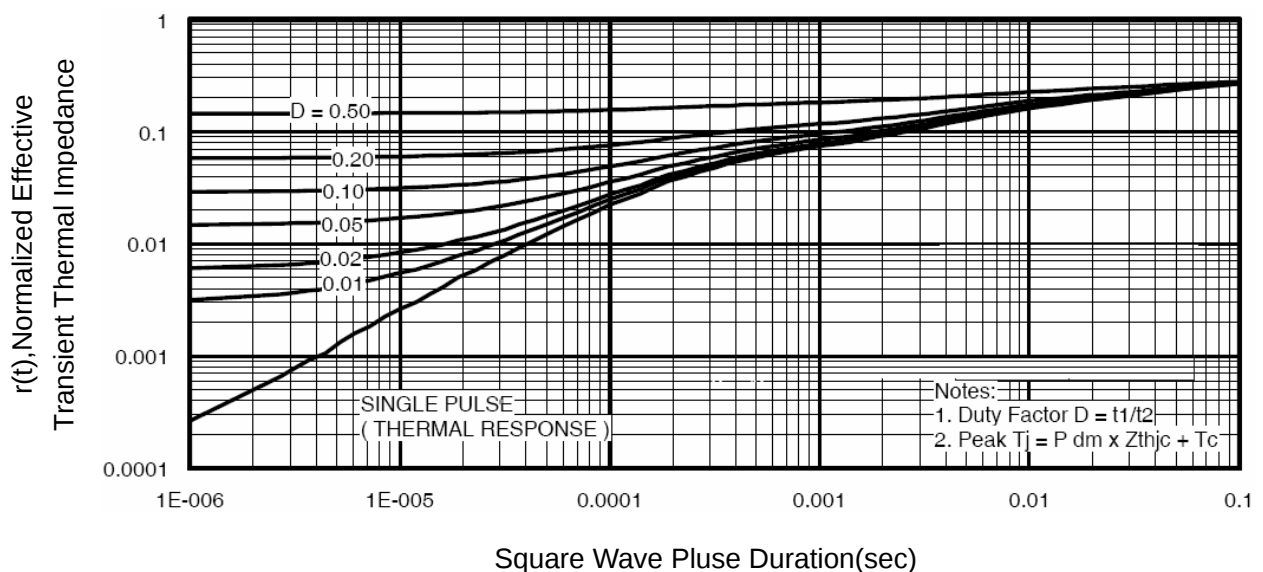
T<sub>J</sub>-Junction Temperature(°C)  
**Figure 9 BV<sub>DSS</sub> vs Junction Temperature**



Vds Drain-Source Voltage (V)  
**Figure 8 Safe Operation Area**

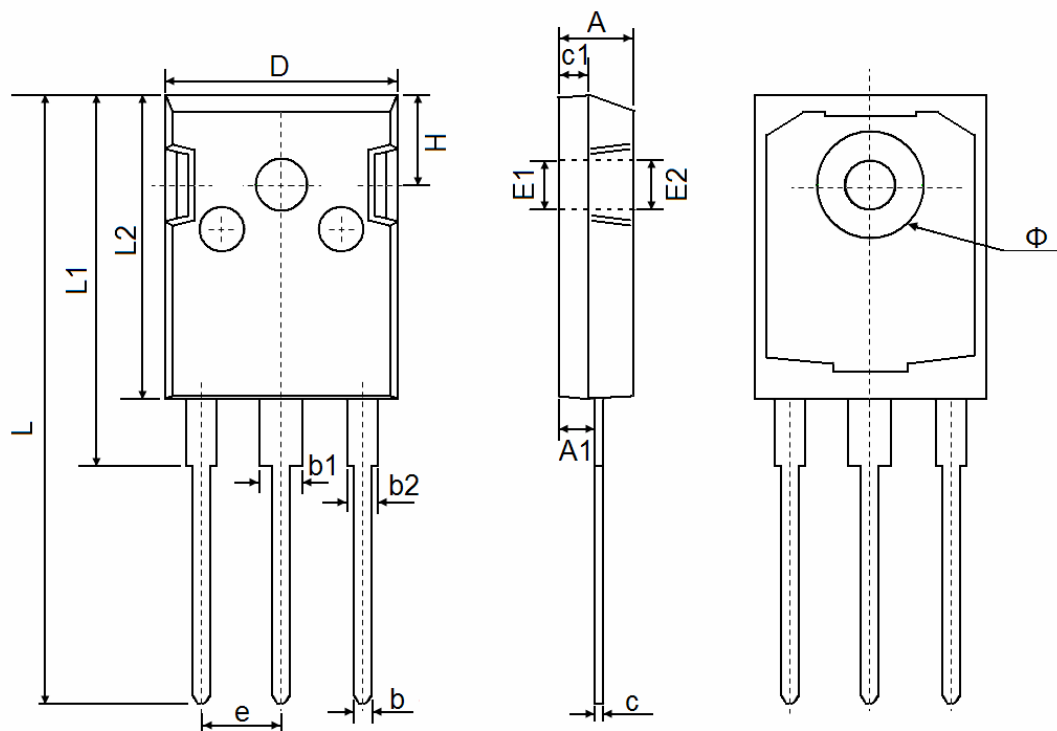


T<sub>J</sub>-Junction Temperature(°C)  
**Figure 10 V<sub>GS(th)</sub> vs Junction Temperature**



**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     | 3.500 REF                 |        | 0.138 REF            |       |
| E2     | 3.600 REF                 |        | 0.142 REF            |       |
| 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      | 5.450 TYP                 |        | 0.215 TYP            |       |
| H      | 5.980 REF                 |        | 0.235 REF            |       |