

## N-Channel Enhancement Mode Power MOSFET

### Description

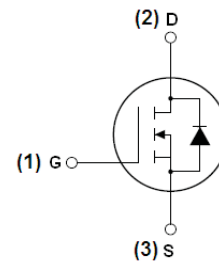
The RM24N200TI uses advanced trench technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. It can be used in a wide variety of applications.

### General Features

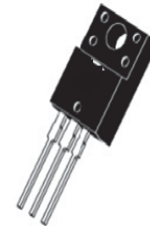
- $V_{DS} = 200V, I_D = 24A$   
 $R_{DS(ON)} < 80m\Omega @ V_{GS} = 10V$  (Typ: 62m $\Omega$ )
- High density cell design for ultra low  $R_{dson}$
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high  $E_{AS}$
- Excellent package for good heat dissipation
- Special process technology for high ESD capability

### Application

- Power switching application
- Hard switched and high frequency circuits
- Uninterruptible power supply



Schematic diagram



TO-220F top view

**100% UIS TESTED!**

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

### Package Marking and Ordering Information

| Device Marking | Device     | Device Package | Reel Size | Tape width | Quantity |
|----------------|------------|----------------|-----------|------------|----------|
| 24N200         | RM24N200TI | TO-220F        | -         | -          | -        |

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

| Parameter   | Symbol             | Limit      | Unit       |
|---|--------------------|------------|------------|
| Drain-Source Voltage                              | $V_{DS}$           | 200        | V          |
| Gate-Source Voltage                               | $V_{GS}$           | $\pm 20$   | V          |
| Drain Current-Continuous                          | $I_D$              | 24         | A          |
| Drain Current-Continuous ( $T_C = 100^\circ C$ )  | $I_D(100^\circ C)$ | 16.5       | A          |
| Pulsed Drain Current                              | $I_{DM}$           | 100        | A          |
| Maximum Power Dissipation                         | $P_D$              | 45         | W          |
| Single pulse avalanche energy <sup>(Note 5)</sup> | $E_{AS}$           | 250        | mJ         |
| Operating Junction and Storage Temperature Range  | $T_J, T_{STG}$     | -55 To 175 | $^\circ C$ |

### Thermal Characteristic

|   |                 |      |              |
|---|-----------------|------|--------------|
| Thermal Resistance, Junction-to-Ambient <sup>(Note 2)</sup> | $R_{\theta JA}$ | 3.33 | $^\circ C/W$ |
|---|-----------------|------|--------------|

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

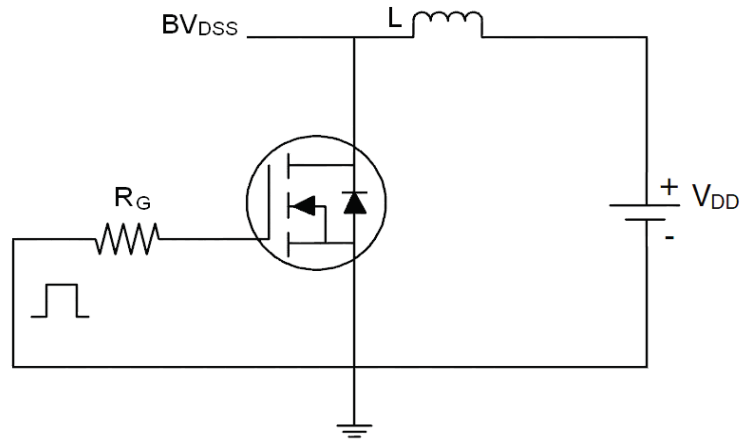
| Parameter                                 | Symbol       | Condition  | Min | Typ  | Max       | Unit       |
|---|--------------|--|-----|------|-----------|------------|
| <b>Off Characteristics</b>                |              |  |     |      |           |            |
| Drain-Source Breakdown Voltage            | $BV_{DSS}$   | $V_{GS}=0V, I_D=250\mu A$  | 200 | 220  | -         | V          |
| Zero Gate Voltage Drain Current           | $I_{DSS}$    | $V_{DS}=200V, V_{GS}=0V$   | -   | -    | 1         | $\mu A$    |
| Gate-Body Leakage Current                 | $I_{GSS}$    | $V_{GS}=\pm 20V, V_{DS}=0V$  | -   | -    | $\pm 100$ | nA         |
| <b>On Characteristics</b> (Note 3)        |              |  |     |      |           |            |
| Gate Threshold Voltage                    | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=250\mu A$  | 1.0 | 1.5  | 2.5       | V          |
| Drain-Source On-State Resistance          | $R_{DS(on)}$ | $V_{GS}=10V, I_D=15A$  | -   | 62   | 80        | m $\Omega$ |
| Forward Transconductance                  | $g_{FS}$     | $V_{DS}=10V, I_D=15A$  | 30  | -    | -         | S          |
| <b>Dynamic Characteristics</b> (Note 4)   |              |  |     |      |           |            |
| Input Capacitance                         | $C_{iss}$    | $V_{DS}=25V, V_{GS}=0V,$<br>$F=1.0\text{MHz}$                          |     | 4200 |           | PF         |
| Output Capacitance                        | $C_{oss}$    |  |     | 163  |           | PF         |
| Reverse Transfer Capacitance              | $C_{rss}$    |  |     | 75   |           | PF         |
| <b>Switching Characteristics</b> (Note 4) |              |  |     |      |           |            |
| Turn-on Delay Time                        | $t_{d(on)}$  | $V_{DD}=100V, I_D=15A$<br>$V_{GS}=10V, R_{GEN}=2.5\Omega$              | -   | 10   | -         | nS         |
| Turn-on Rise Time                         | $t_r$        |  | -   | 18   | -         | nS         |
| Turn-Off Delay Time                       | $t_{d(off)}$ |  | -   | 22   | -         | nS         |
| Turn-Off Fall Time                        | $t_f$        |  | -   | 5    | -         | nS         |
| Total Gate Charge                         | $Q_g$        | $V_{DS}=100V, I_D=15A,$<br>$V_{GS}=10V$                                |     | 60   |           | nC         |
| Gate-Source Charge                        | $Q_{gs}$     |  |     | 19   |           | nC         |
| Gate-Drain Charge                         | $Q_{gd}$     |  |     | 17   |           | nC         |
| <b>Drain-Source Diode Characteristics</b> |              |  |     |      |           |            |
| Diode Forward Voltage (Note 3)            | $V_{SD}$     | $V_{GS}=0V, I_S=15A$   | -   | -    | 1.2       | V          |
| Diode Forward Current (Note 2)            | $I_S$        | -  | -   | -    | 24        | A          |
| Reverse Recovery Time                     | $t_{rr}$     | $T_J = 25^{\circ}\text{C}, I_F = 15A$<br>$di/dt = 100A/\mu s$ (Note 3) | -   | 90   | -         | nS         |
| Reverse Recovery Charge                   | $Q_{rr}$     |  | -   | 300  | -         | nC         |

### Notes:

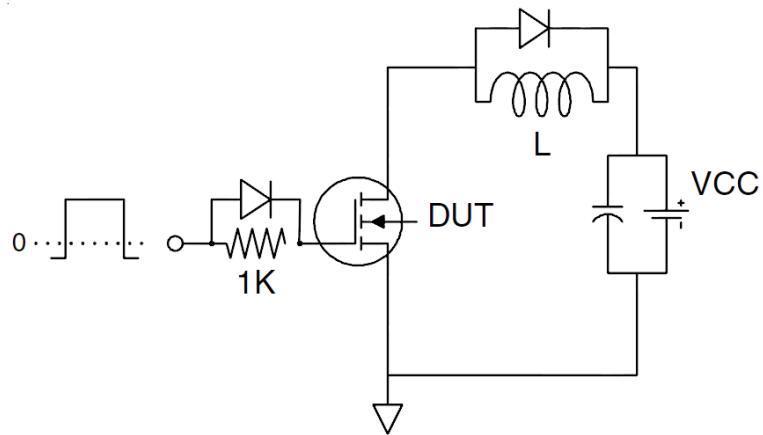
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production
5. EAS condition:  $T_J=25^{\circ}\text{C}, V_{DD}=50V, V_G=10V, L=0.5\text{mH}, R_g=25\Omega$

## Test Circuit

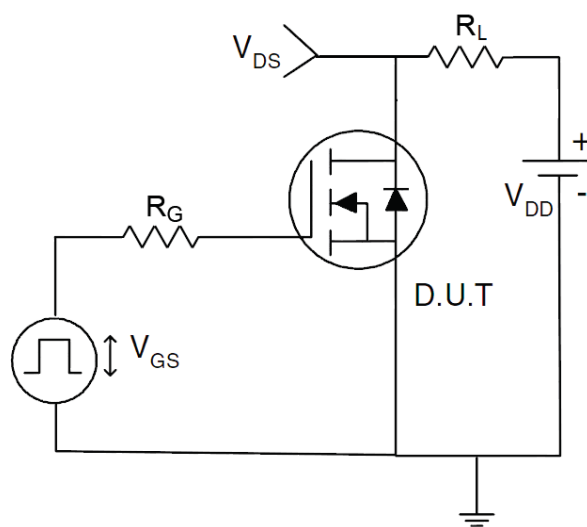
### 1) $E_{AS}$ Test Circuits



### 2) Gate Charge Test Circuit



### 3) Switch Time Test Circuit



## RATING AND CHARACTERISTICS CURVES (RM24N200TI)

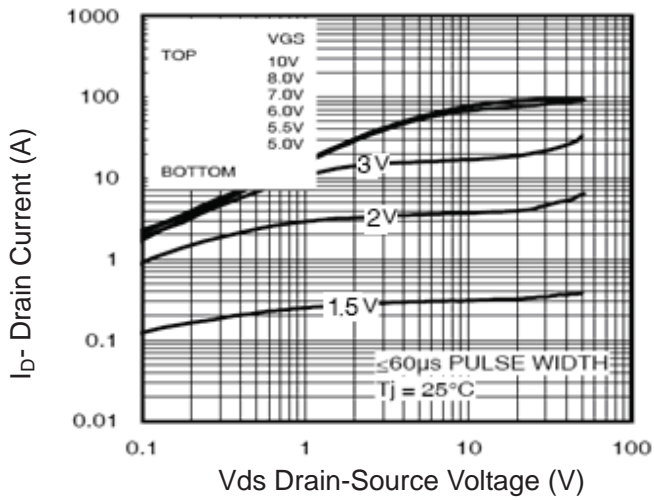


Figure 1 Output Characteristics

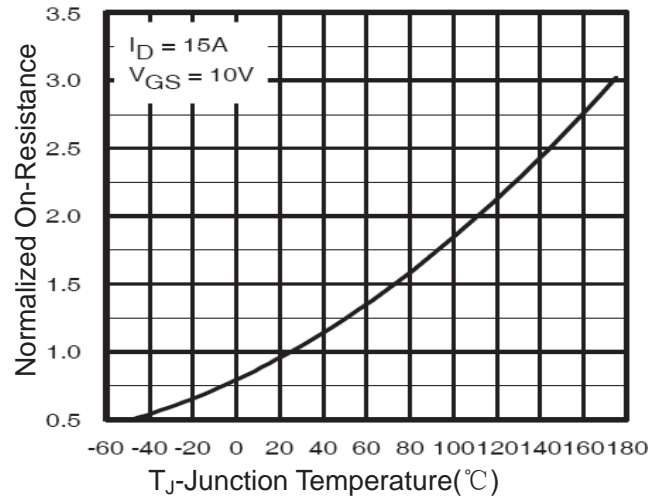


Figure 4  $R_{dson}$ -Junction Temperature

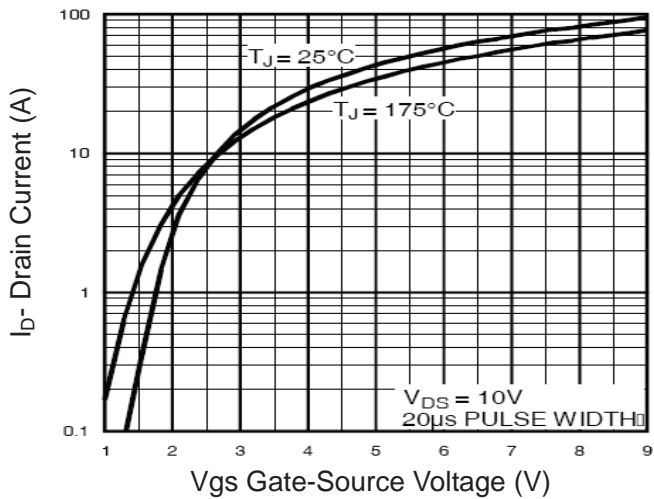


Figure 2 Transfer Characteristics

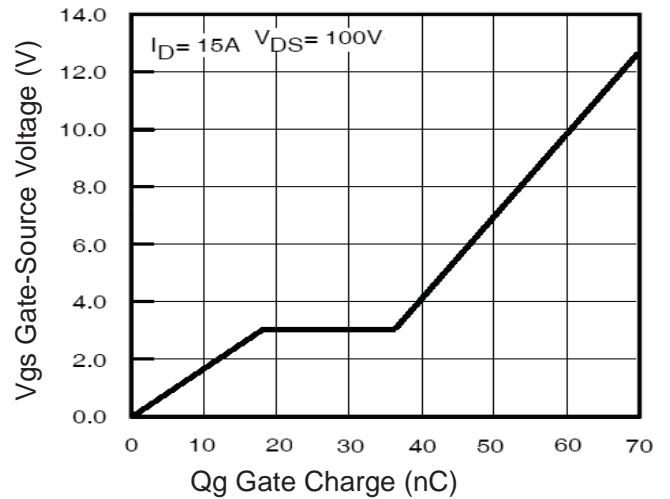


Figure 5 Gate Charge

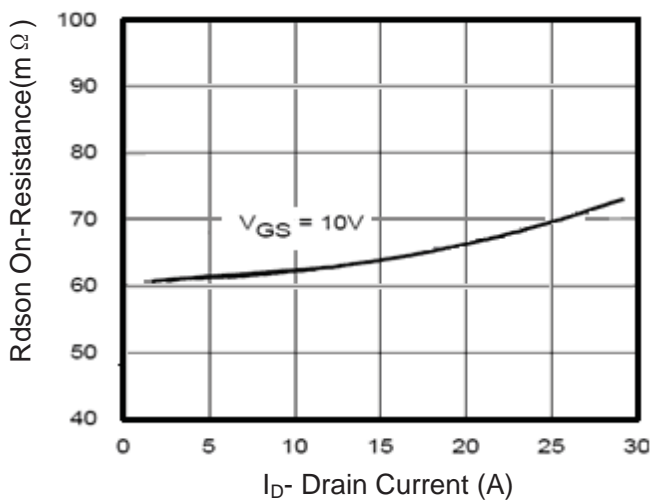


Figure 3  $R_{dson}$ - Drain Current

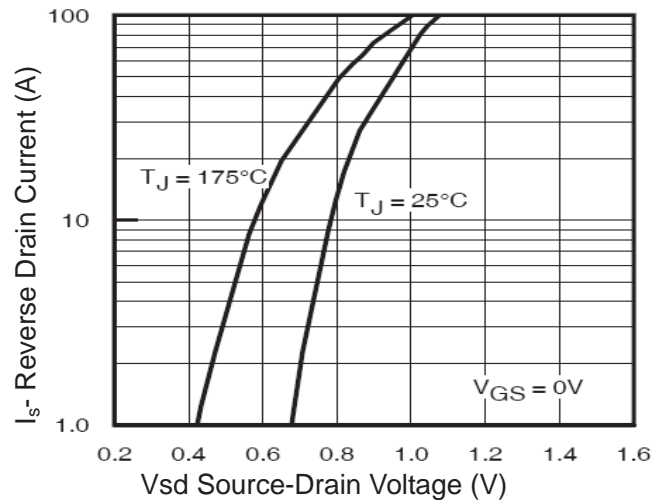
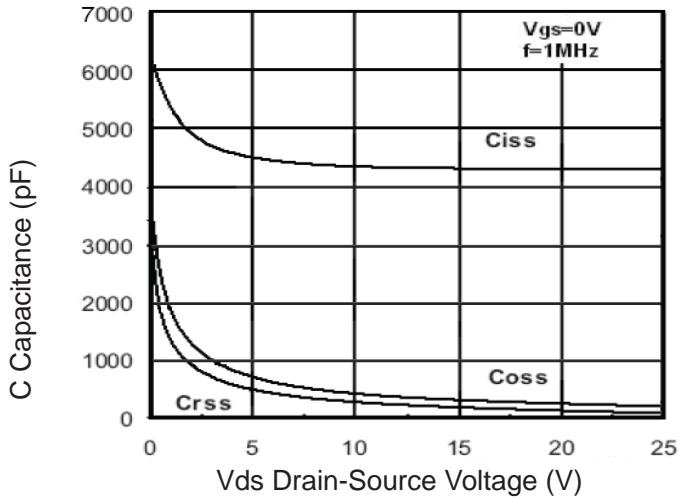
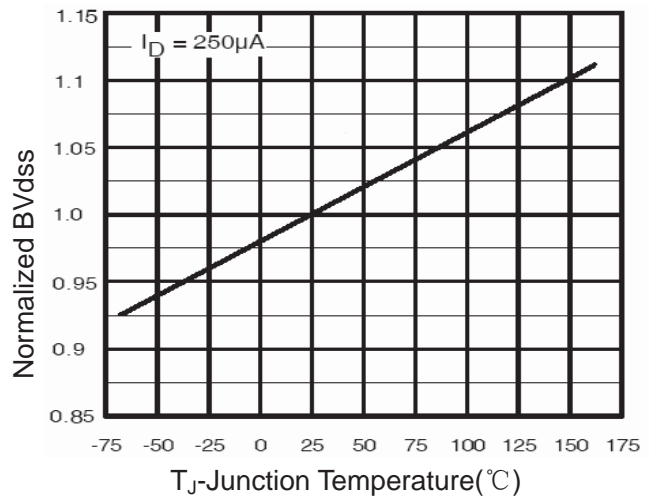


Figure 6 Source- Drain Diode Forward

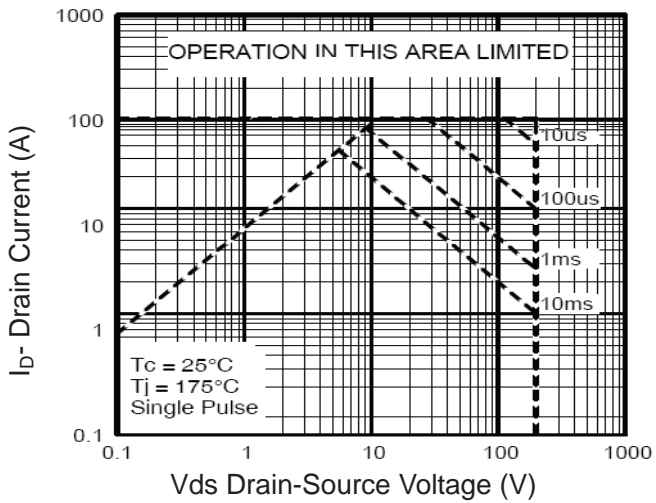
## RATING AND CHARACTERISTICS CURVES (RM24N200TI)



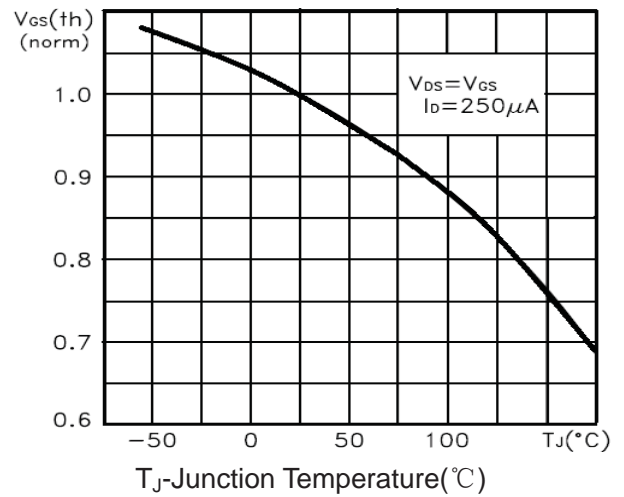
**Figure 7 Capacitance vs Vds**



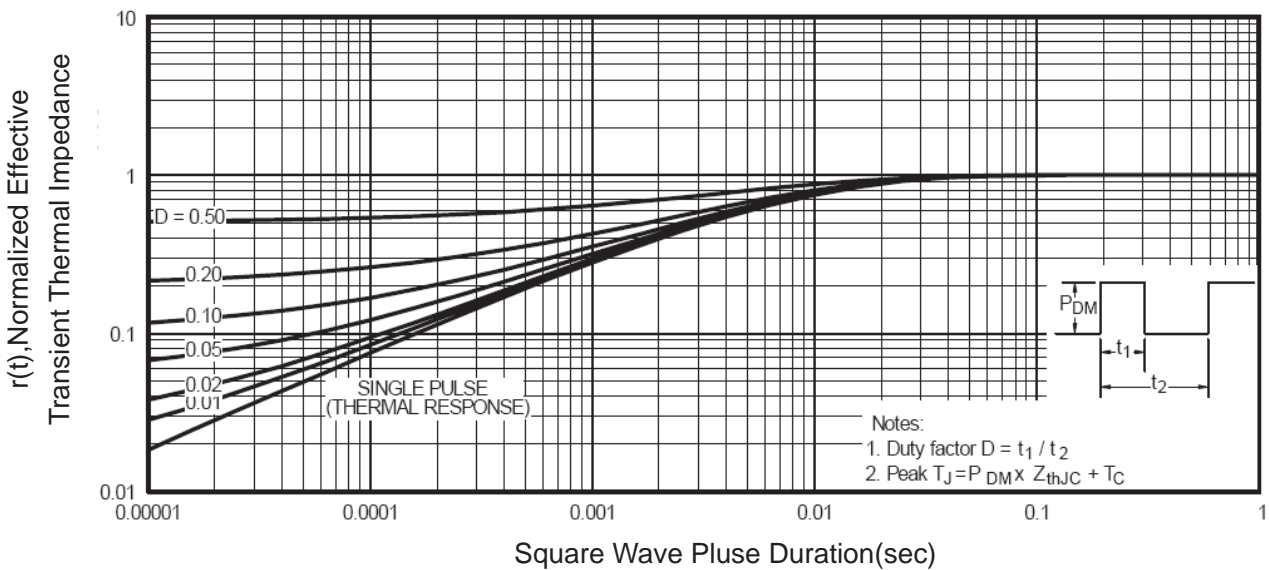
**Figure 9 BV<sub>DSS</sub> vs Junction Temperature**



**Figure 8 Safe Operation Area**

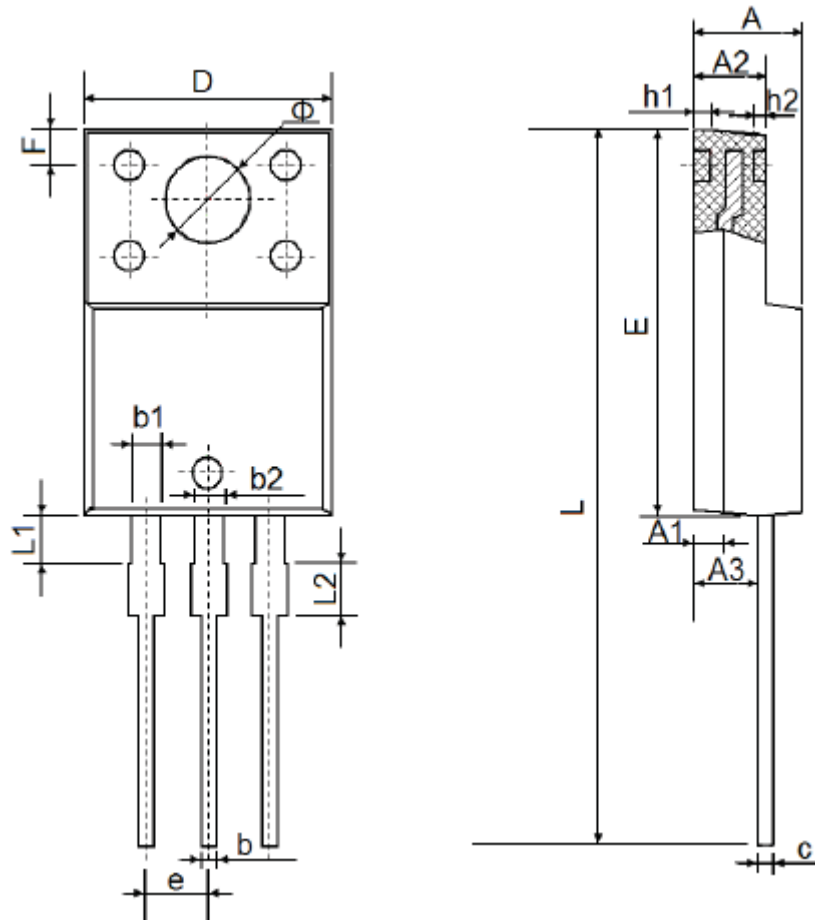


**Figure 10 V<sub>GS(th)</sub> vs Junction Temperature**



**Figure 11 Normalized Maximum Transient Thermal Impedance**

## TO-220F Package Information



| Symbol | Dimensions In Millimeters |        | Dimensions In Inches |       |
|--------|---------------------------|--------|----------------------|-------|
|        | Min.                      | Max.   | Min.                 | Max.  |
| A      | 4.300                     | 4.700  | 0.169                | 0.185 |
| A1     | 1.300REF                  |        | 0.051REF             |       |
| A2     | 2.800                     | 3.200  | 0.110                | 0.126 |
| A3     | 2.500                     | 2.900  | 0.098                | 0.114 |
| b      | 0.500                     | 0.750  | 0.020                | 0.030 |
| b1     | 1.100                     | 1.350  | 0.043                | 0.053 |
| b2     | 1.500                     | 1.750  | 0.059                | 0.069 |
| c      | 0.500                     | 0.750  | 0.020                | 0.030 |
| D      | 9.960                     | 10.360 | 0.392                | 0.408 |
| E      | 14.800                    | 15.200 | 0.583                | 0.598 |
| e      | 2.540TYP.                 |        | 0.100TYP             |       |
| F      | 2.700REF                  |        | 0.106REF             |       |
| $\Phi$ | 3.500REF                  |        | 0.138REF             |       |
| h1     | 0.800REF                  |        | 0.031REF             |       |
| h2     | 0.500REF                  |        | 0.020REF             |       |
| L      | 28.000                    | 28.400 | 1.102                | 1.118 |
| L1     | 1.700                     | 1.900  | 0.067                | 0.075 |
| L2     | 1.900                     | 2.100  | 0.075                | 0.083 |

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