

## N-Channel Trench Power MOSFET

### General Description

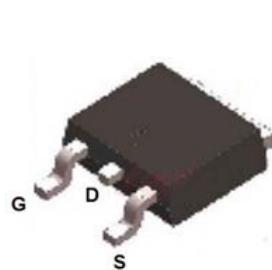
The HM1607D is N-channel MOS Field Effect Transistor designed for high current switching applications. Rugged EAS capability and ultra low  $R_{DS(ON)}$  is suitable for PWM.

### Features

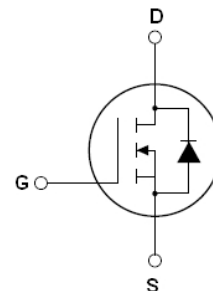
- $V_{DS}=75V$ ;  $I_D=150A$ @  $V_{GS}=10V$ ;  
 $R_{DS(ON)}<6.3m\Omega$  @  $V_{GS}=10V$
- Ultra Low On-Resistance
- High UIS and UIS 100% Test

### Application

- Hard Switched and High Frequency Circuits
- Uninterruptible Power Supply



TO-263-2L Top View



Schematic Diagram

$$V_{DS} = 75V$$

$$I_D = 150A$$

$$R_{DS(ON)} = 5.0m\Omega$$

### Package Marking and Ordering Information

| Device Marking | Device  | Device Package | Reel Size | Tape width | Quantity |
|----------------|---------|----------------|-----------|------------|----------|
| HM1607D        | HM1607D | TO-263-2L      | -         | -          |          |

**Table 1. Absolute Maximum Ratings (TA=25°C)**

| Symbol          | Parameter                                         | Value      | Unit |
|-----------------|---------------------------------------------------|------------|------|
| $V_{DS}$        | Drain-Source Voltage ( $V_{GS}=0V$ )              | 75         | V    |
| $V_{GS}$        | Gate-Source Voltage ( $V_{DS}=0V$ )               | $\pm 25$   | V    |
| $I_{D(DC)}$     | Drain Current (DC) at $T_c=25^\circ C$            | 150        | A    |
| $I_{D(DC)}$     | Drain Current (DC) at $T_c=100^\circ C$           | 115        | A    |
| $I_{DM(pluse)}$ | Drain Current-Continuous@ Current-Pulsed (Note 1) | 600        | A    |
| $P_D$           | Maximum Power Dissipation( $T_c=25^\circ C$ )     | 380        | W    |
|                 | Derating Factor                                   | 2.5        | W/°C |
| $E_{AS}$        | Single Pulse Avalanche Energy (Note 2)            | 1000       | mJ   |
| $T_J, T_{STG}$  | Operating Junction and Storage Temperature Range  | -55 To 175 | °C   |

Notes 1.Repetitive Rating: Pulse width limited by maximum junction temperature

2.EAS condition:  $T_J=25^\circ C$ ,  $V_{DD}=50V$ ,  $V_G=10V$ ,  $R_G=25\Omega$

**Table 2. Thermal Characteristic**

| Symbol   | Parameter                            | Value | Unit                        |
|----------|--------------------------------------|-------|-----------------------------|
| $R_{JC}$ | Thermal Resistance, Junction-to-Case | 0.4   | $^{\circ}\text{C}/\text{W}$ |

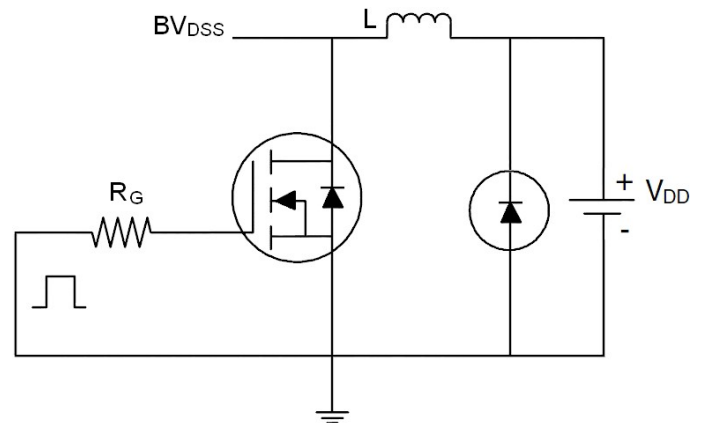
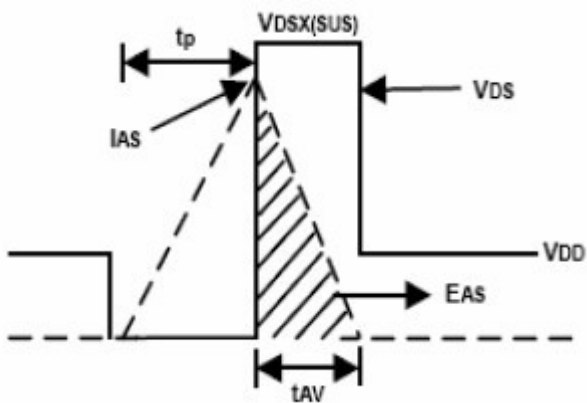
**Table 3. Electrical Characteristics (TA=25 $^{\circ}\text{C}$  unless otherwise noted)**

| Symbol                             | Parameter                                   | Conditions                                                                                                   | Min | Typ  | Max  | Unit |
|------------------------------------|---------------------------------------------|--------------------------------------------------------------------------------------------------------------|-----|------|------|------|
| On/Off States                      |                                             |                                                                                                              |     |      |      |      |
| BV <sub>DSS</sub>                  | Drain-Source Breakdown Voltage              | V <sub>GS</sub> =0V I <sub>D</sub> =250μA                                                                    | 75  |      |      | V    |
| I <sub>DSS</sub>                   | Zero Gate Voltage Drain Current(Tc=25℃)     | V <sub>DS</sub> =100V, V <sub>GS</sub> =0V                                                                   |     |      | 1    | μA   |
| I <sub>DSS</sub>                   | Zero Gate Voltage Drain Current(Tc=125℃)    | V <sub>DS</sub> =100V, V <sub>GS</sub> =0V                                                                   |     |      | 1    | μA   |
| I <sub>GSS</sub>                   | Gate-Body Leakage Current                   | V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V                                                                   |     |      | ±100 | nA   |
| V <sub>GS(th)</sub>                | Gate Threshold Voltage                      | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                                                     | 2   |      | 4    | V    |
| R <sub>DS(ON)</sub>                | Drain-Source On-State Resistance            | V <sub>GS</sub> =10V, I <sub>D</sub> =40A                                                                    |     | 5.0  | 6.3  | mΩ   |
| Dynamic Characteristics            |                                             |                                                                                                              |     |      |      |      |
| g <sub>FS</sub>                    | Forward Transconductance                    | V <sub>DS</sub> =50V, I <sub>D</sub> =40A                                                                    | 30  |      |      | S    |
| C <sub>iss</sub>                   | Input Capacitance                           | V <sub>DS</sub> =25V, V <sub>GS</sub> =0V<br>f=1.0MHz                                                        |     | 8184 |      | PF   |
| C <sub>oss</sub>                   | Output Capacitance                          |                                                                                                              |     | 955  |      | PF   |
| C <sub>rss</sub>                   | Reverse Transfer Capacitance                |                                                                                                              |     | 463  |      | PF   |
| Q <sub>g</sub>                     | Total Gate Charge                           | V <sub>DS</sub> =44V, I <sub>D</sub> =40A<br>V <sub>GS</sub> =10V                                            |     | 158  |      | nC   |
| Q <sub>gs</sub>                    | Gate-Source Charge                          |                                                                                                              |     | 29   |      | nC   |
| Q <sub>gd</sub>                    | Gate-Drain Charge                           |                                                                                                              |     | 42   |      | nC   |
| Switching Times                    |                                             |                                                                                                              |     |      |      |      |
| t <sub>d(on)</sub>                 | Turn-on Delay Time                          | V <sub>DD</sub> =65V, I <sub>D</sub> =40A, R <sub>L</sub> =15Ω<br>V <sub>GS</sub> =10V, R <sub>G</sub> =2.5Ω |     | 25   |      | nS   |
| t <sub>r</sub>                     | Turn-on Rise Time                           |                                                                                                              |     | 29   |      | nS   |
| t <sub>d(off)</sub>                | Turn-Off Delay Time                         |                                                                                                              |     | 53   |      | nS   |
| t <sub>f</sub>                     | Turn-Off Fall Time                          |                                                                                                              |     | 63   |      | nS   |
| Source-Drain Diode Characteristics |                                             |                                                                                                              |     |      |      |      |
| I <sub>SD</sub>                    | Source-Drain Current(Body Diode)            |                                                                                                              |     | 150  |      | A    |
| I <sub>SDM</sub>                   | Pulsed Source-Drain Current(Body Diode)     |                                                                                                              |     | 600  |      | A    |
| V <sub>SD</sub>                    | Forward On Voltage <sup>(Note 1)</sup>      | T <sub>J</sub> =25℃, I <sub>SD</sub> =40A, V <sub>GS</sub> =0V                                               |     | 0.8  | 1    | V    |
| t <sub>rr</sub>                    | Reverse Recovery Time <sup>(Note 1)</sup>   | T <sub>J</sub> =25℃, I <sub>F</sub> =40A<br>di/dt=100A/μs                                                    |     | 95   |      | nS   |
| Q <sub>rr</sub>                    | Reverse Recovery Charge <sup>(Note 1)</sup> |                                                                                                              |     | 189  |      | nC   |
| t <sub>on</sub>                    | Forward Turn-on Time                        | Intrinsic turn-on time is negligible(turn-on is dominated by L <sub>S</sub> +L <sub>D</sub> )                |     |      |      |      |

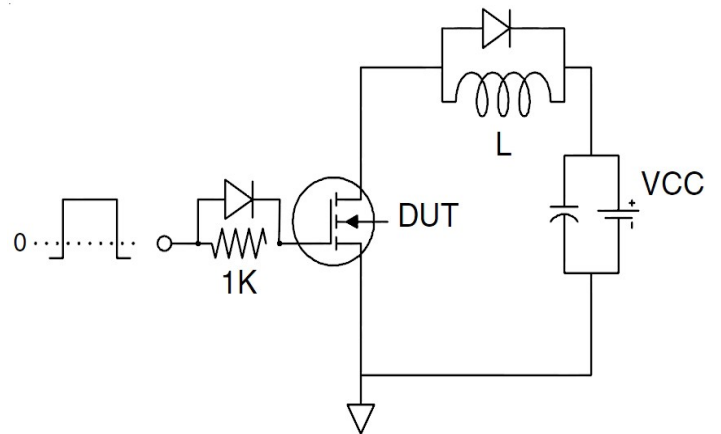
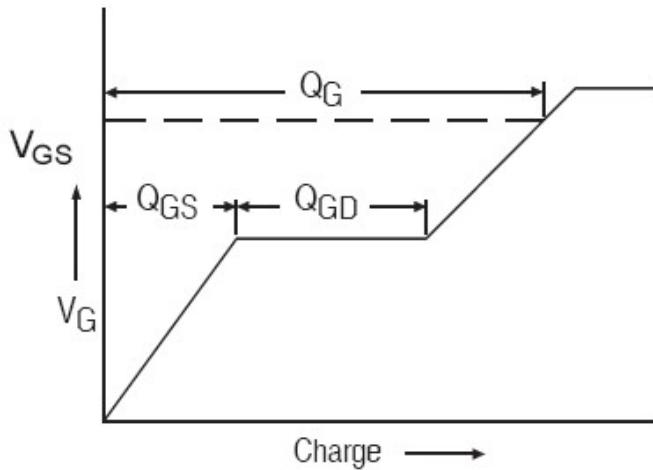
**Notes 1.** Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 1.5\%$ ,  $R_G=25\Omega$ , Starting  $T_J=25^{\circ}\text{C}$

## Test Circuit

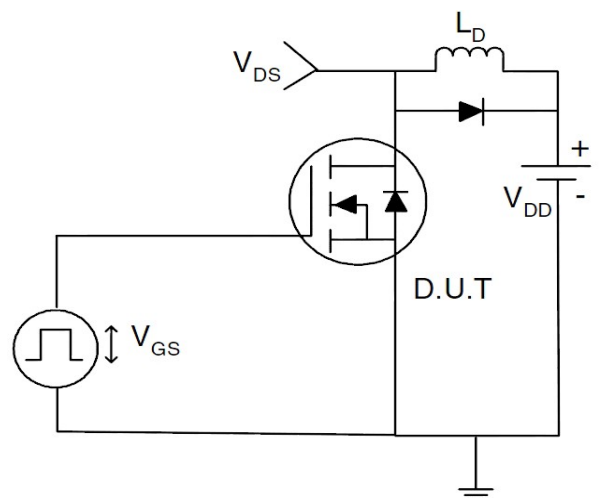
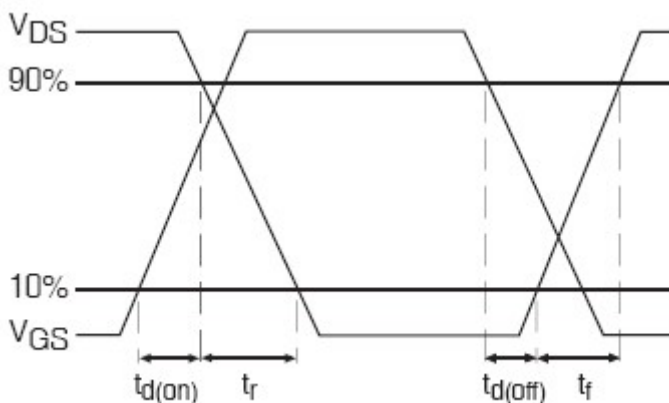
### 1) $E_{AS}$ Test Circuits



### 2) Gate Charge Test Circuit:



### 3) Switch Time Test Circuit:



# TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (Curves)

Figure1. Output Characteristics

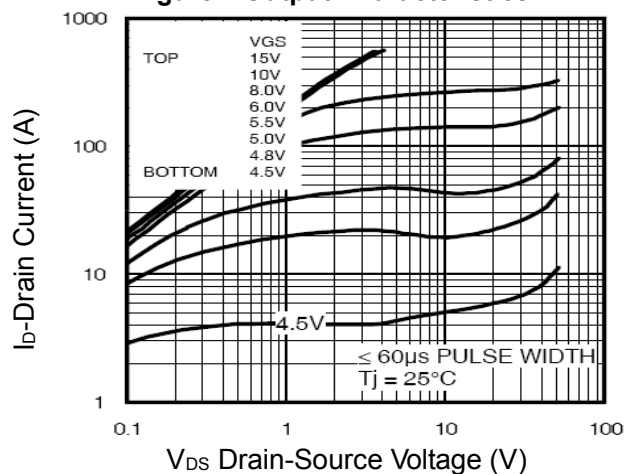


Figure2. Transfer Characteristics

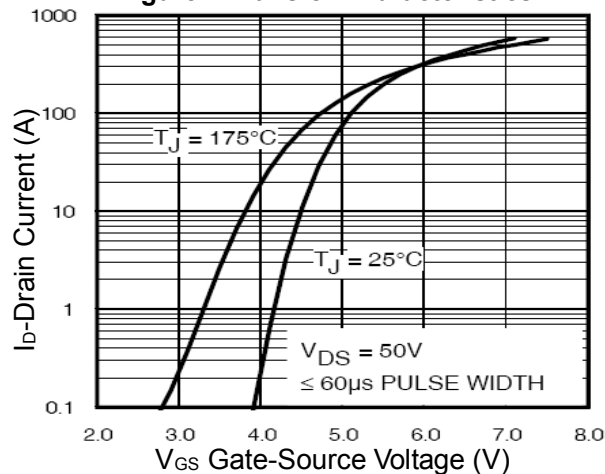


Figure3.  $R_{DS(ON)}$ - Drain Current

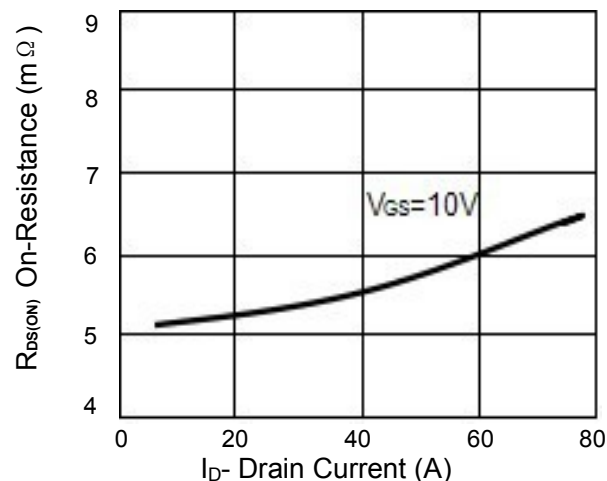


Figure4.  $R_{DS(ON)}$ - Junction Temperature

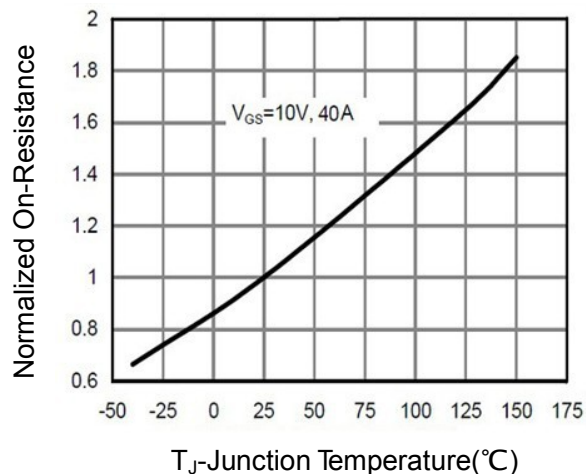


Figure5. Gate Charge

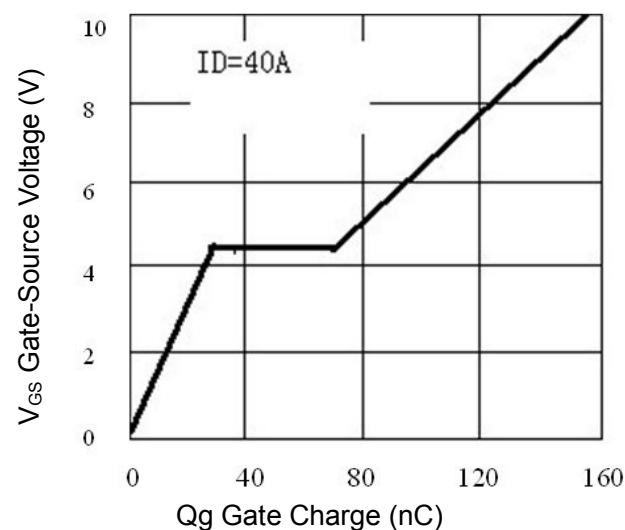


Figure6. Source- Drain Diode Forward

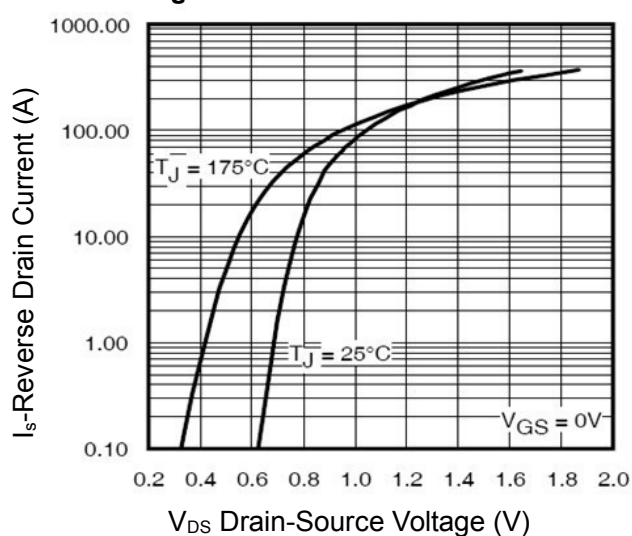


Figure7. Capacitance vs V<sub>DS</sub>

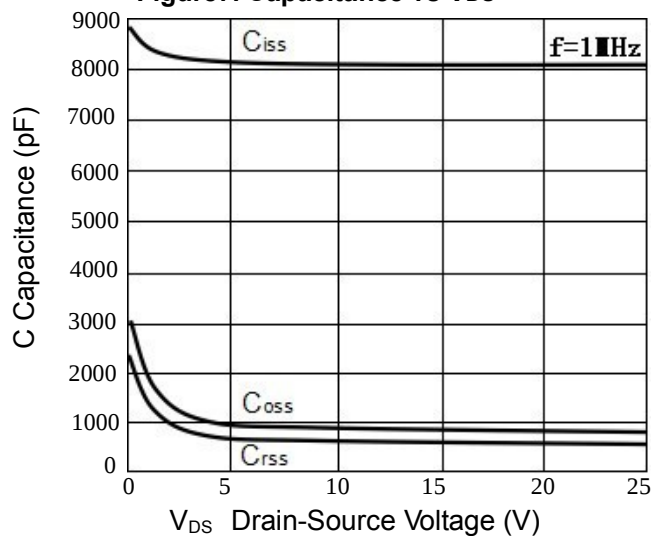


Figure8. Safe Operation Area

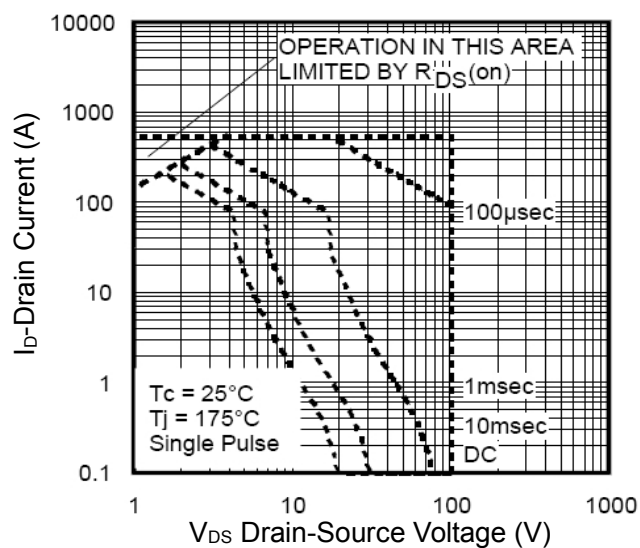


Figure9. BV<sub>DSS</sub> vs Junction Temperature

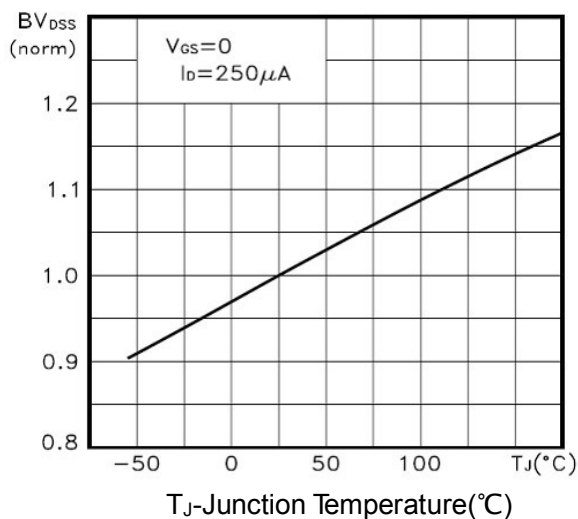


Figure10. V<sub>GS(th)</sub> vs Junction Temperature

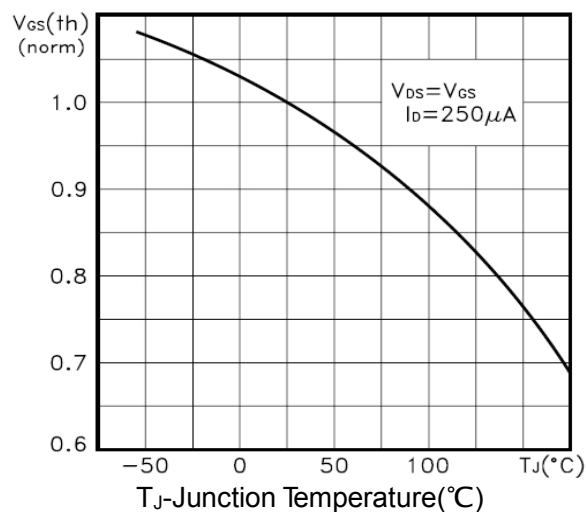
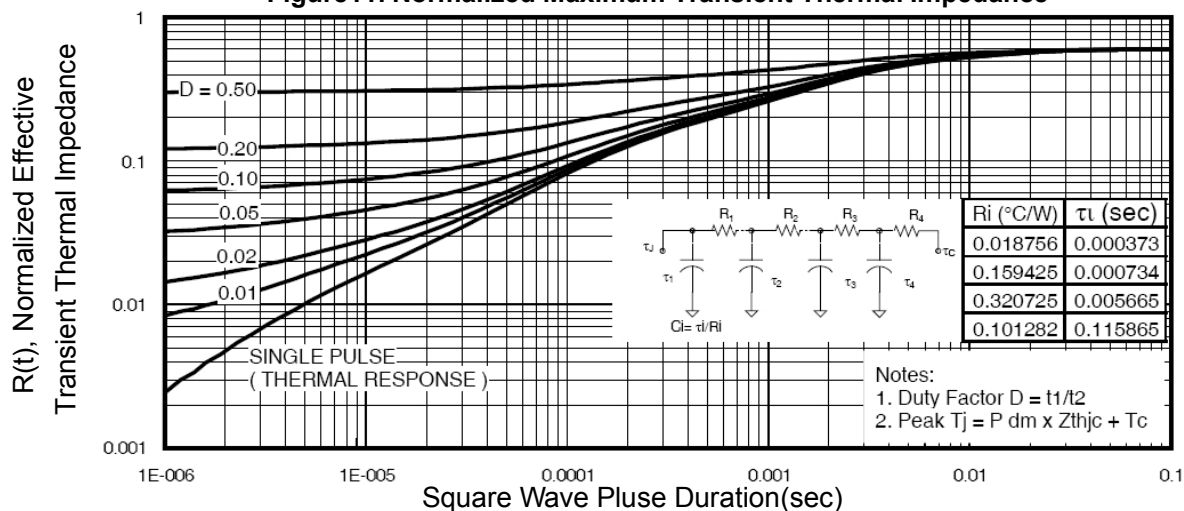
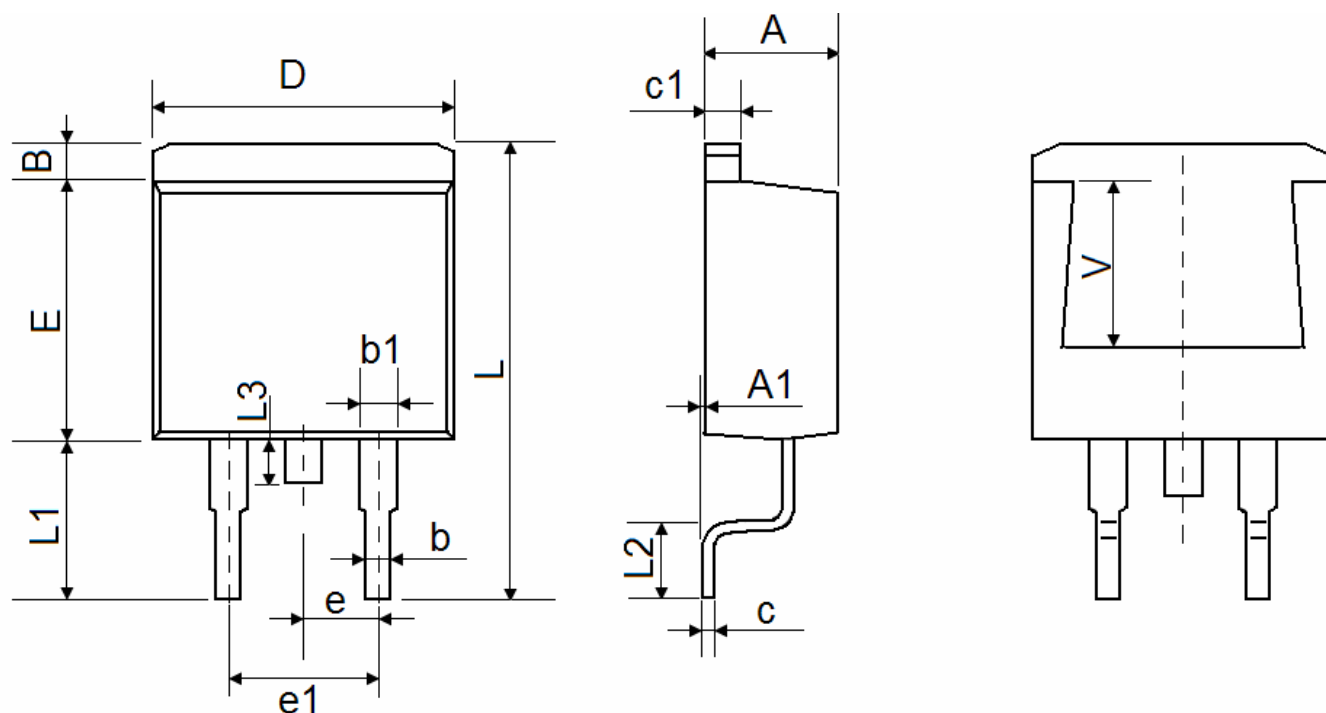


Figure11. Normalized Maximum Transient Thermal Impedance



TO-263-2L Package Information



| Symbol | Dimensions In Millimeters |        | Dimensions In Inches |       |
|--------|---------------------------|--------|----------------------|-------|
|        | Min.                      | Max.   | Min.                 | Max.  |
| A      | 4.470                     | 4.670  | 0.176                | 0.184 |
| A1     | 0.000                     | 0.150  | 0.000                | 0.006 |
| B      | 1.170                     | 1.370  | 0.046                | 0.054 |
| b      | 0.710                     | 0.910  | 0.028                | 0.036 |
| b1     | 1.170                     | 1.370  | 0.046                | 0.054 |
| c      | 0.310                     | 0.530  | 0.012                | 0.021 |
| c1     | 1.170                     | 1.370  | 0.046                | 0.054 |
| D      | 10.010                    | 10.310 | 0.394                | 0.406 |
| E      | 8.500                     | 8.900  | 0.335                | 0.350 |
| e      | 2.540 TYP.                |        | 0.100 TYP.           |       |
| e1     | 4.980                     | 5.180  | 0.196                | 0.204 |
| L      | 15.050                    | 15.450 | 0.593                | 0.608 |
| L1     | 5.080                     | 5.480  | 0.200                | 0.216 |
| L2     | 2.340                     | 2.740  | 0.092                | 0.108 |
| L3     | 1.300                     | 1.700  | 0.051                | 0.067 |
| V      | 5.600 REF                 |        | 0.220 REF            |       |