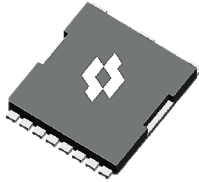
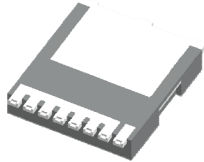


**Product Summary**

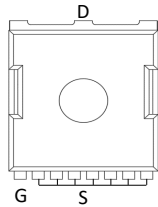
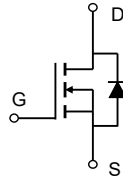
| $V_{DS}$ | $R_{DS(ON)_TYP}$         | $I_{D\_MAX}$ |
|----------|--------------------------|--------------|
| 40 V     | 0.95 mΩ @ $V_{GS} = 10V$ | 356 A        |

**TOLL**


Top View



Bottom View


 PIN Configuration  
(Top View)


Schematic Diagram

**Sinesemi Automotive MOSFET**

**Features**

- N-Channel Enhancement Mode - Standard Level
- AEC-Q101 Qualified, PPAP Capable
- 175°C Operating Temperature
- 100%  $\Delta V_{DS}$  & UIS & Rg Tested

**Applications**

- General Automotive Applications

**Mechanical Data**

- Green Molding Compound
- Moisture Sensitivity: Level 1 per J-STD-020
- UL Flammability Classification Rating 94V-0

**Ordering Information**

| Orderable Part Number | Package Type | Device Marking | Form          | Quantity (pcs) |
|-----------------------|--------------|----------------|---------------|----------------|
| SMT4001AHTLQ          | TOLL         | 4001AHQ        | 13" Tape&Reel | 2,000          |

**Maximum Ratings** (@  $T_C = 25^\circ\text{C}$ , unless otherwise specified.)

| Parameter                                                       |                        | Symbol                            | Value      | Unit |
|-----------------------------------------------------------------|------------------------|-----------------------------------|------------|------|
| Drain - Source Voltage                                          |                        | V <sub>DS</sub>                   | 40         | V    |
| Gate - Source Voltage                                           |                        | V <sub>GS</sub>                   | ±20        | V    |
| Continuous Drain Current (V <sub>GS</sub> = 10V) <sup>(1)</sup> | T <sub>C</sub> = 25°C  | I <sub>D</sub>                    | 356        | A    |
|                                                                 | T <sub>C</sub> = 100°C |                                   | 252        | A    |
| Pulsed Drain Current <sup>(2)</sup>                             |                        | I <sub>DM</sub>                   | 1424       | A    |
| Single Pulse Avalanche Energy <sup>(3)</sup>                    |                        | E <sub>AS</sub>                   | 960        | mJ   |
| Single Pulse Avalanche Current (L= 0.3mH)                       |                        | I <sub>AS</sub>                   | 53         | A    |
| Power Dissipation                                               | T <sub>C</sub> = 25°C  | P <sub>D</sub>                    | 254        | W    |
|                                                                 | T <sub>C</sub> = 100°C |                                   | 127        | W    |
| Junction & Storage Temperature Range                            |                        | T <sub>J</sub> , T <sub>STG</sub> | -55 ~ +175 | °C   |

**Thermal Characteristics**

| Parameter                                              | Symbol          | Typ. | Max. | Unit               |
|--------------------------------------------------------|-----------------|------|------|--------------------|
| Thermal Resistance, Junction-to-Ambient <sup>(4)</sup> | $R_{\theta JA}$ | 26   | 33   | $^\circ\text{C/W}$ |
| Thermal Resistance, Junction-to-Case <sup>(5)</sup>    | $R_{\theta JC}$ | 0.45 | 0.59 | $^\circ\text{C/W}$ |

**Electrical Characteristics** (@  $T_J = 25^\circ\text{C}$ , unless otherwise specified.)

| Parameter                                         | Symbol               | Test Condition                                                                                | Min. | Typ. | Max. | Unit |
|---------------------------------------------------|----------------------|-----------------------------------------------------------------------------------------------|------|------|------|------|
| Off Characteristics <sup>(6)</sup>                |                      |                                                                                               |      |      |      |      |
| Drain-Source Breakdown Voltage                    | V <sub>(BR)DSS</sub> | V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA                                                  | 40   | -    | -    | V    |
| Zero Gate Voltage Drain Current                   | I <sub>DSS</sub>     | V <sub>DS</sub> = 40V, V <sub>GS</sub> = 0V                                                   | -    | -    | 1.0  | μA   |
|                                                   |                      | T <sub>J</sub> = 125°C                                                                        | -    | -    | 100  | μA   |
| Gate-Source Leakage Current                       | I <sub>GSS</sub>     | V <sub>GS</sub> = ±20V, V <sub>DS</sub> = 0V                                                  | -    | -    | ±100 | nA   |
| On Characteristics <sup>(6)</sup>                 |                      |                                                                                               |      |      |      |      |
| Gate Threshold Voltage                            | V <sub>GS(th)</sub>  | V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 250μA                                    | 2.0  | 3.0  | 4.0  | V    |
| Static Drain-Source On-Resistance                 | R <sub>DS(ON)</sub>  | V <sub>GS</sub> = 10V, I <sub>D</sub> = 80A                                                   | -    | 0.95 | 1.2  | mΩ   |
| Forward Transconductance                          | g <sub>fs</sub>      | V <sub>DS</sub> = 5.0V, I <sub>D</sub> = 20A                                                  | -    | 63   | -    | S    |
| Diodes Forward Voltage                            | V <sub>SD</sub>      | I <sub>S</sub> = 2.0A, V <sub>GS</sub> = 0V                                                   | -    | 0.7  | 1.2  | V    |
| Dynamic Characteristics <sup>(7)</sup>            |                      |                                                                                               |      |      |      |      |
| Input Capacitance                                 | C <sub>iss</sub>     | V <sub>DS</sub> = 20V, V <sub>GS</sub> = 0V, f = 1MHz                                         | -    | 5654 | 7350 | pF   |
| Output Capacitance                                | C <sub>oss</sub>     |                                                                                               | -    | 3337 | 4338 | pF   |
| Reverse Transfer Capacitance                      | C <sub>rss</sub>     |                                                                                               | -    | 99   | 198  | pF   |
| Gate Resistance                                   | R <sub>g</sub>       | V <sub>GS</sub> = 0V, V <sub>DS</sub> = 0V, f = 1MHz                                          | -    | 2.1  | -    | Ω    |
| Switching Characteristics <sup>(7)</sup>          |                      |                                                                                               |      |      |      |      |
| Turn-On DelayTime                                 | t <sub>d(on)</sub>   | V <sub>GS</sub> = 10V, V <sub>DS</sub> = 20V<br>I <sub>D</sub> = 80A, R <sub>GEN</sub> = 3.0Ω | -    | 4.4  | -    | ns   |
| Rise Time                                         | t <sub>r</sub>       |                                                                                               | -    | 21   | -    | ns   |
| Turn-Off DelayTime                                | t <sub>d(off)</sub>  |                                                                                               | -    | 40   | -    | ns   |
| Fall Time                                         | t <sub>f</sub>       |                                                                                               | -    | 19   | -    | ns   |
| Gate Charge Characteristics <sup>(7)</sup>        |                      |                                                                                               |      |      |      |      |
| Total Gate Charge (V <sub>GS</sub> = 10V)         | Q <sub>g</sub>       | V <sub>DS</sub> = 20V, I <sub>D</sub> = 80A<br>V <sub>GS</sub> = 10V                          | -    | 73   | 95   | nC   |
| Total Gate Charge (V <sub>GS</sub> = 7.0V)        | Q <sub>g</sub>       |                                                                                               | -    | 52   | 68   | nC   |
| Gate-Source Charge                                | Q <sub>gs</sub>      |                                                                                               | -    | 23   | 35   | nC   |
| Gate-Drain Charge                                 | Q <sub>gd</sub>      |                                                                                               | -    | 12.2 | 18.3 | nC   |
| Gate Plateau Voltage                              | V <sub>plateau</sub> |                                                                                               | -    | 4.5  | -    | V    |
| Drain-Source Diode Characteristics <sup>(7)</sup> |                      |                                                                                               |      |      |      |      |
| Body Diode Reverse Recovery Time                  | t <sub>rr</sub>      | I <sub>F</sub> = 20A, dI/dt = 100A/μs,                                                        | -    | 72   | -    | ns   |
| Body Diode Reverse Recovery Charge                | Q <sub>rr</sub>      | T <sub>J</sub> = 25°C                                                                         | -    | 110  | -    | nC   |
| Diode Forward Current                             | I <sub>S</sub>       | T <sub>C</sub> = 25°C                                                                         | -    | -    | 356  | A    |

**Notes:**

1. This current is chip limited, which is calculated based on  $R_{thjc}$ .
2. This current is calculated on single pulse with 10 $\mu s$  Single Pulse.
3. Defined by design, not subject to production test,  $E_{AS}$  condition:  $T_J = 25^\circ\text{C}$ ,  $V_{DD} = 20V$ ,  $V_{GS} = 10V$ ,  $L = 1.0\text{mH}$ .
4. Device mounted on FR-4 substrate PC board with 2oz copper in 1inch square cooling area.
5. Thermal resistance from junction to the exposed pad.
6. Short duration pulse test used to minimize self-heating effect.
7. Defined by design, not subject to production.

### Typical Electrical and Thermal Characteristics

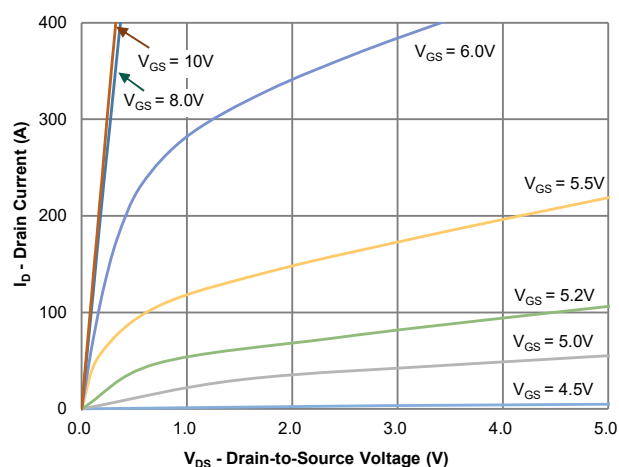


Figure 1: Output Characteristics

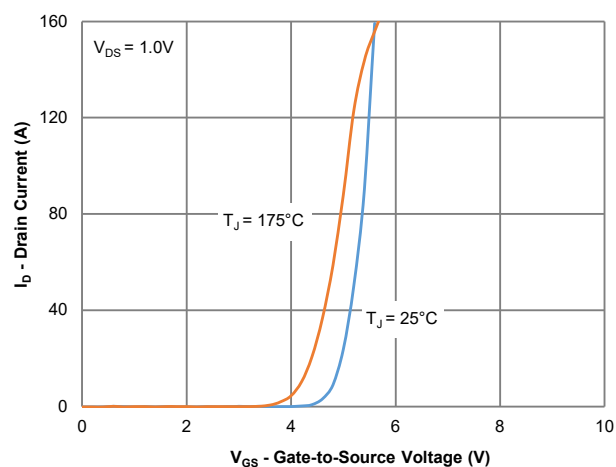


Figure 2: Transfer Characteristics

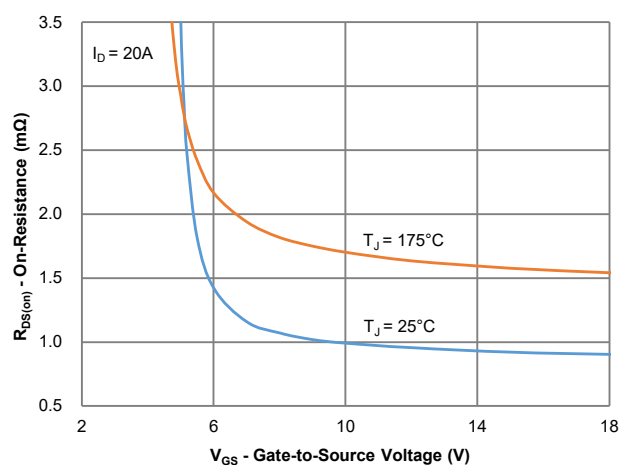


Figure 3: On-Resistance vs. Gate-Source Voltage

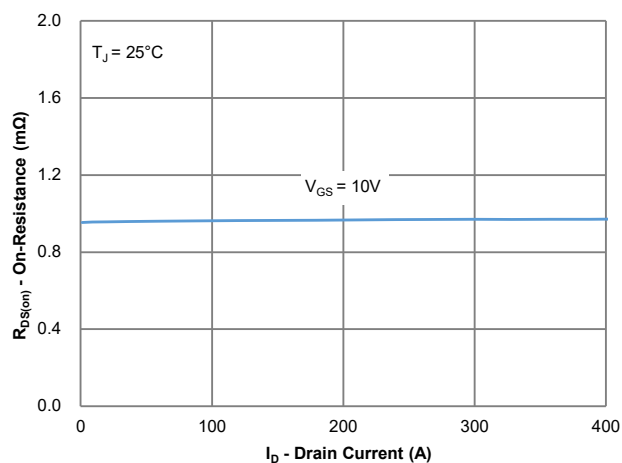


Figure 4: On-Resistance vs. Drain Current and Gate Voltage

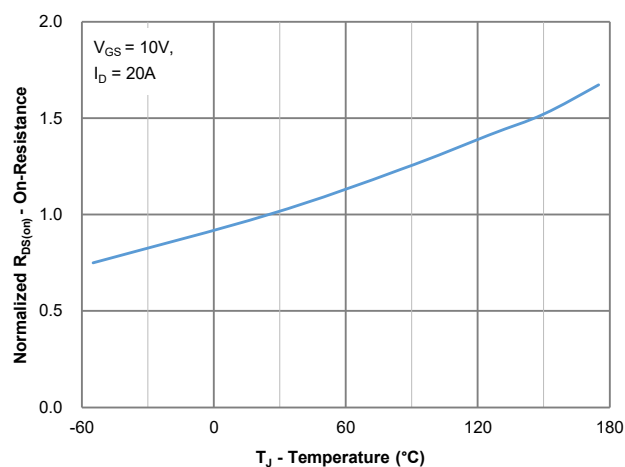


Figure 5: On-Resistance vs. Junction Temperature

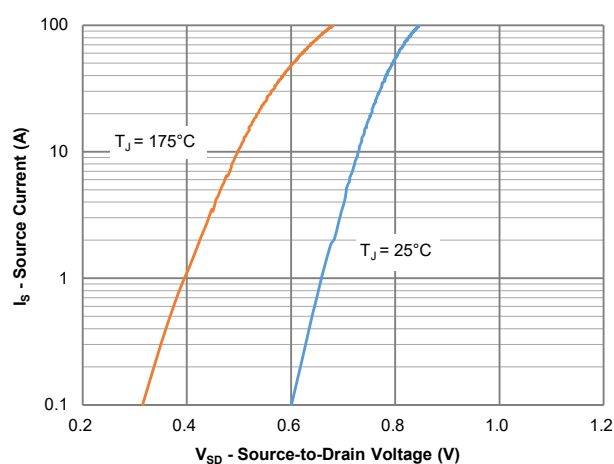


Figure 6: Source-Drain Diode Forward Voltage

### Typical Electrical and Thermal Characteristics

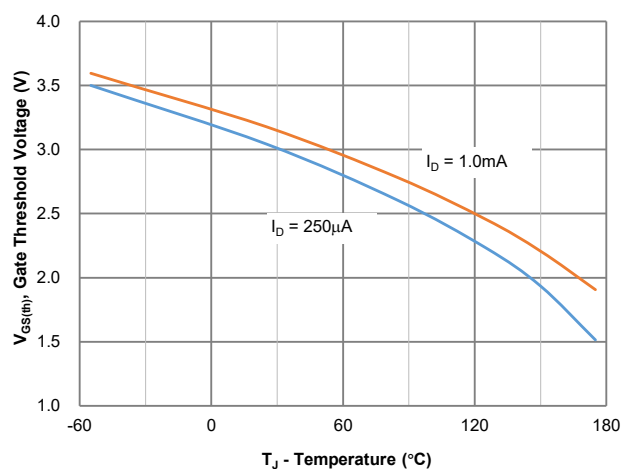


Figure 7: Gate Threshold Variation vs. Junction Temperature

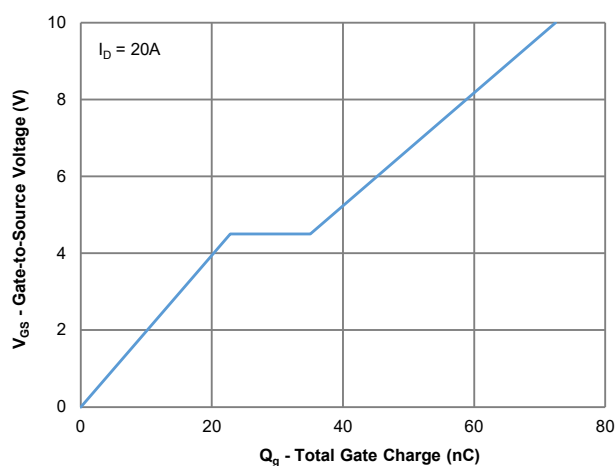


Figure 8: Gate Charge Characteristics

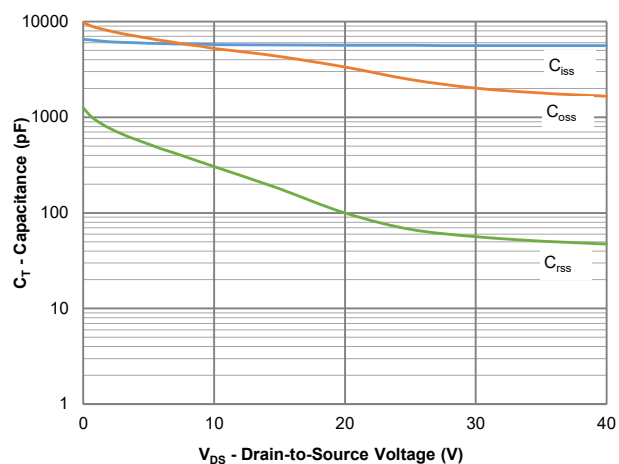


Figure 9: Capacitance Characteristics

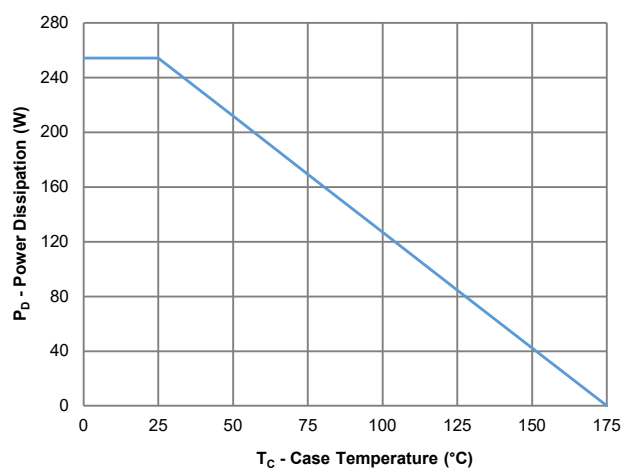


Figure 10: Power Derating

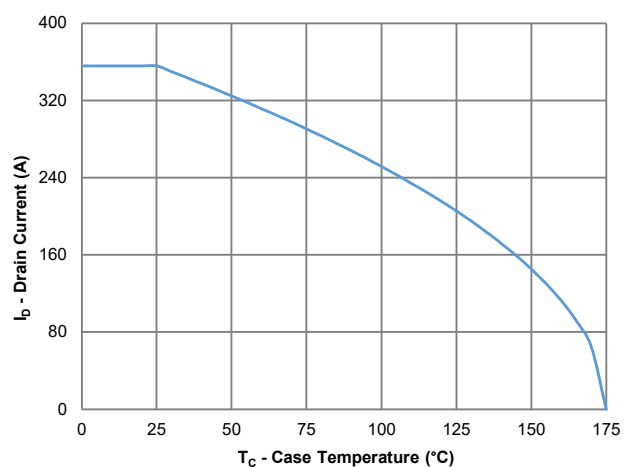


Figure 11: Current Derating

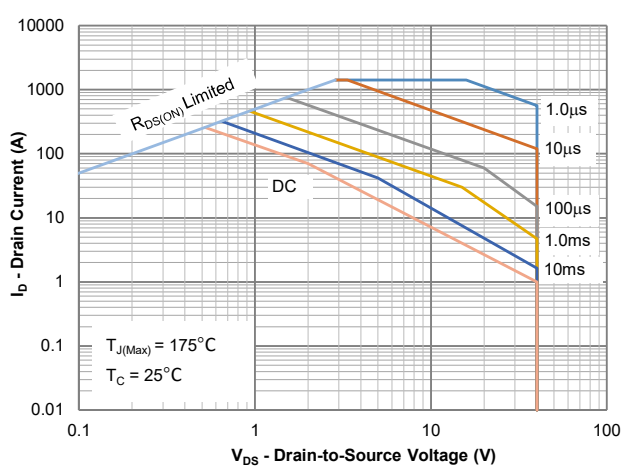
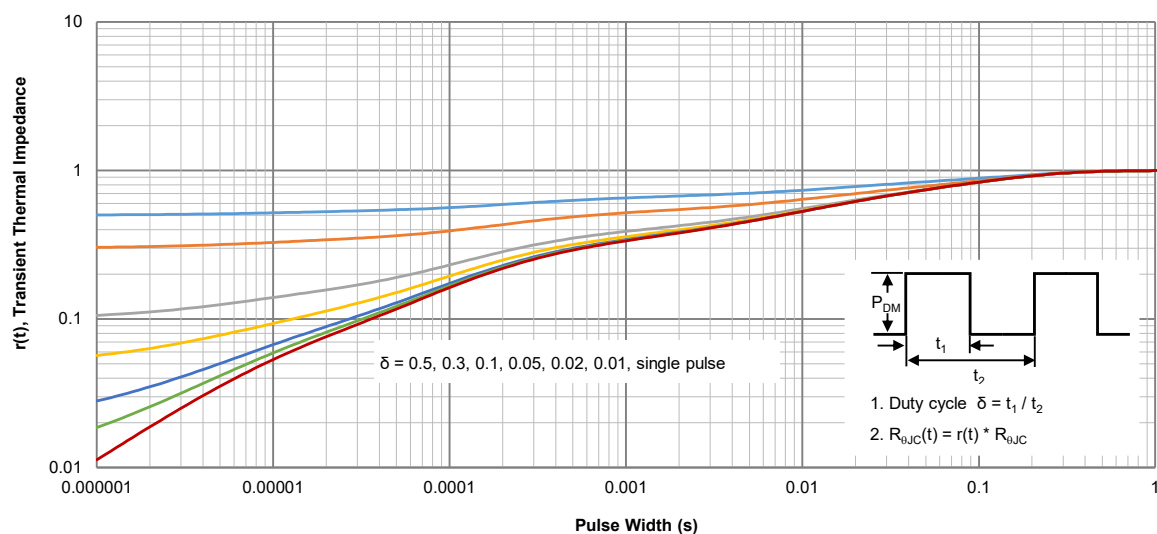
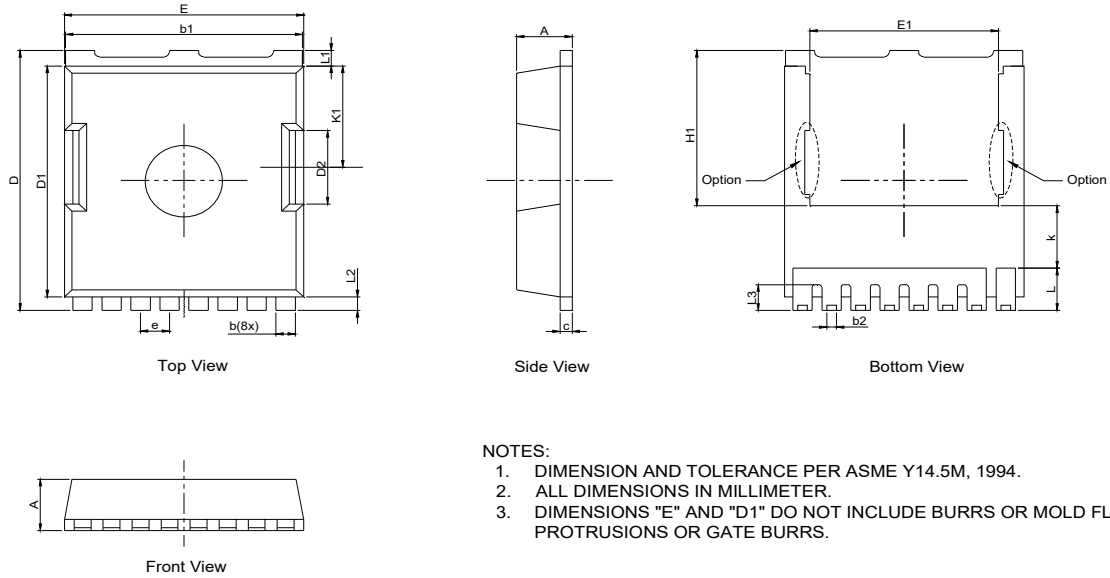


Figure 12: Safe Operating Area

**Typical Electrical and Thermal Characteristics**

**Figure 13: Normalized Maximum Transient Thermal Impedance**

**TOLL Package Outline**
**Package Outlines**

**NOTES:**

1. DIMENSION AND TOLERANCE PER ASME Y14.5M, 1994.
2. ALL DIMENSIONS IN MILLIMETER.
3. DIMENSIONS "E" AND "D1" DO NOT INCLUDE BURRS OR MOLD FLASH. PROTRUSIONS OR GATE BURRS.

| DIM. | MILLIMETER |        |        |
|------|------------|--------|--------|
|      | MIN.       | NOM.   | MAX.   |
| A    | 2.200      | 2.300  | 2.400  |
| b    | 0.650      | 0.800  | 0.900  |
| b1   | 9.650      | 9.800  | 9.950  |
| b2   | 0.400 REF  |        |        |
| c    | 0.400      | 0.500  | 0.600  |
| D    | 11.480     | 11.680 | 11.950 |
| D1   | 10.250     | --     | 10.700 |
| D2   | 2.850      | --     | 3.400  |
| E    | 9.700      | 9.900  | 10.100 |
| E1   | 8.000      | --     | 9.250  |
| e    | 1.200 BSC  |        |        |
| H1   | 6.700      | 7.000  | 7.300  |
| k    | 3.000 REF  |        |        |
| k1   | 4.550 REF  |        |        |
| L    | 1.350      | --     | 2.100  |
| L1   | 0.700 REF  |        |        |
| L2   | 0.600 REF  |        |        |
| L3   | 0.950      | 1.200  | 1.350  |

**Recommended Soldering Footprint**
