

**Product Summary**

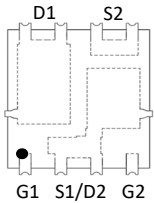
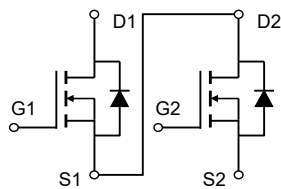
| $V_{DS}$ | $R_{DS(ON)_TYP}$                | $I_{D\_MAX}$ |
|----------|---------------------------------|--------------|
| 40 V     | 3.6 m $\Omega$ @ $V_{GS} = 10V$ | 79 A         |

**PDFN5060-8L-HW**


Top View



Bottom View


 PIN Configuration  
(Top View)

 Chip-1 & Chip-2  
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 &  $R_g$  Tested
- Wettable Flank for Improved Optical Inspection

**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) |
|-----------------------|----------------|----------------|---------------|----------------|
| SMT4004AHPHQ          | PDFN5060-8L-HW | 4004AHQ        | 13" Tape&Reel | 5,000          |

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

| Parameter                                                  | Symbol         | Value                           | Unit             |
|------------------------------------------------------------|----------------|---------------------------------|------------------|
| Drain - Source Voltage                                     | $V_{DS}$       | 40                              | V                |
| Gate - Source Voltage                                      | $V_{GS}$       | $\pm 20$                        | V                |
| Continuous Drain Current ( $V_{GS} = 10V$ ) <sup>(1)</sup> | $I_D$          | $T_C = 25^\circ\text{C}$<br>79  | A                |
|                                                            |                | $T_C = 100^\circ\text{C}$<br>56 | A                |
| Pulsed Drain Current <sup>(2)</sup>                        | $I_{DM}$       | 271                             | A                |
| Single Pulse Avalanche Energy <sup>(3)</sup>               | $E_{AS}$       | 130                             | mJ               |
| Single Pulse Avalanche Current ( $L = 0.1\text{mH}$ )      | $I_{AS}$       | 28                              | A                |
| Power Dissipation                                          | $P_D$          | $T_C = 25^\circ\text{C}$<br>48  | W                |
|                                                            |                | $T_C = 100^\circ\text{C}$<br>24 | W                |
| Junction & Storage Temperature Range                       | $T_J, T_{STG}$ | -55 ~ +175                      | $^\circ\text{C}$ |

**Thermal Characteristics**

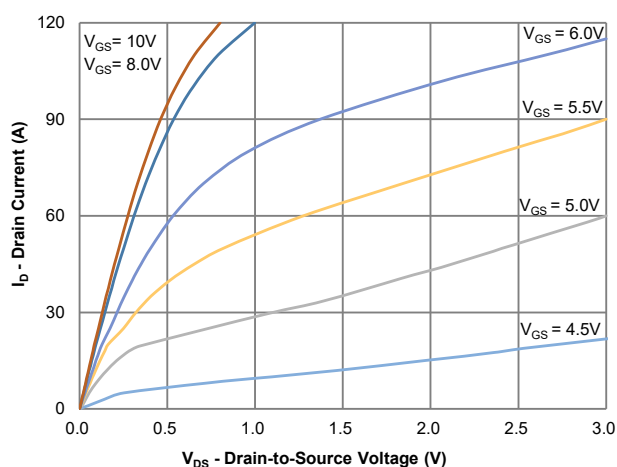
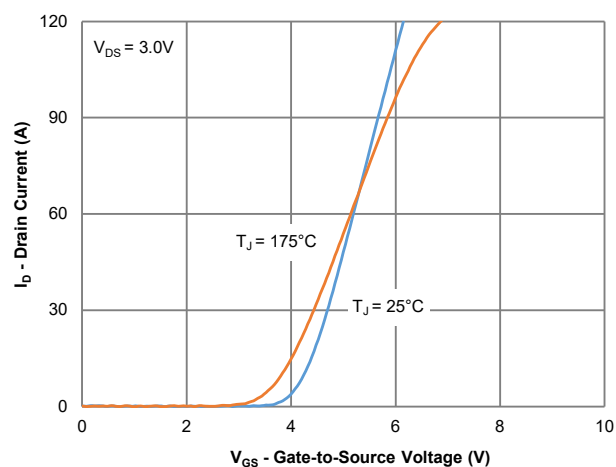
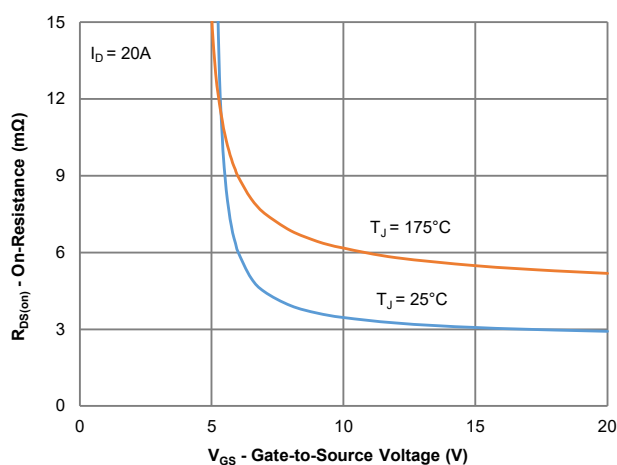
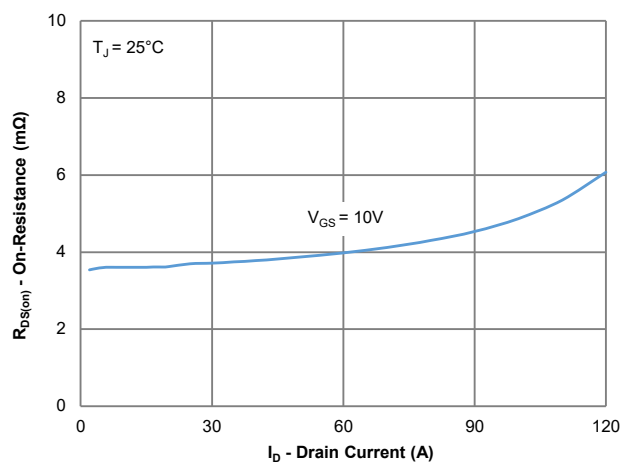
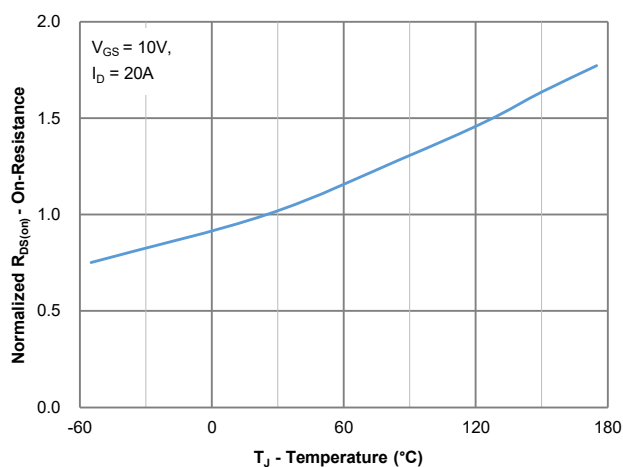
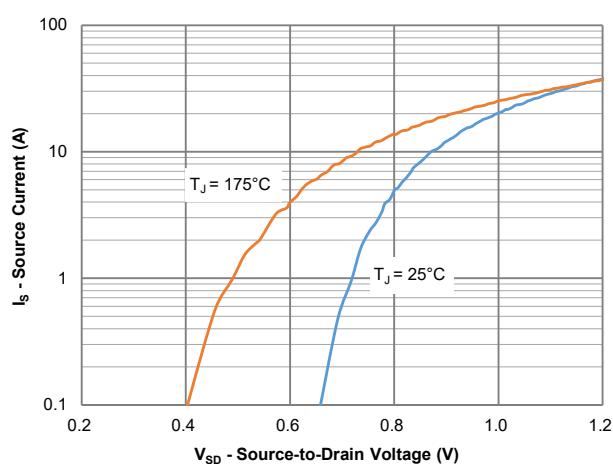
| Parameter                                              | Symbol          | Typ. | Max. | Unit               |
|--------------------------------------------------------|-----------------|------|------|--------------------|
| Thermal Resistance, Junction-to-Ambient <sup>(4)</sup> | $R_{\theta JA}$ | 43   | 54   | $^\circ\text{C/W}$ |
| Thermal Resistance, Junction-to-Case <sup>(5)</sup>    | $R_{\theta JC}$ | 2.4  | 3.1  | $^\circ\text{C/W}$ |

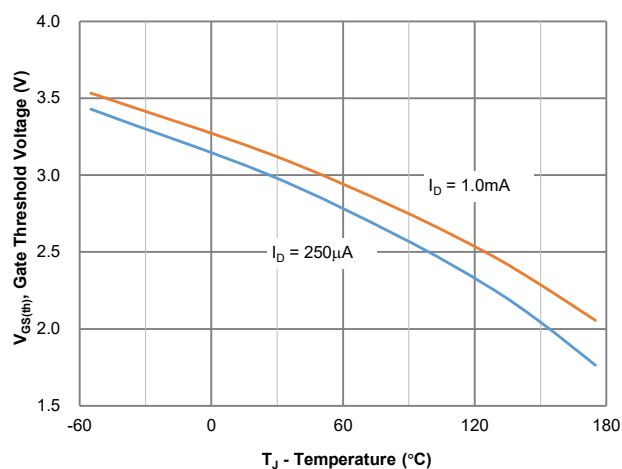
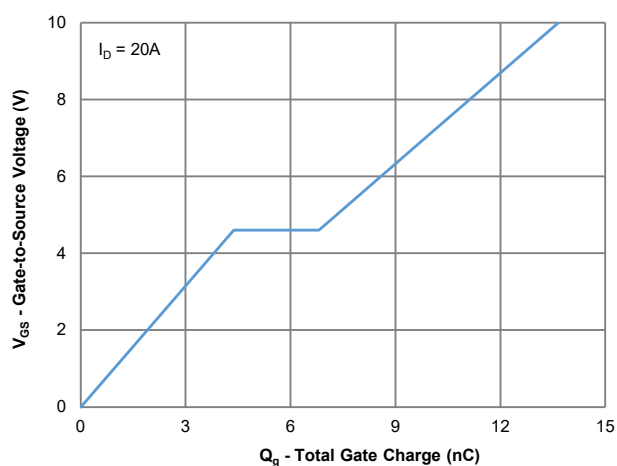
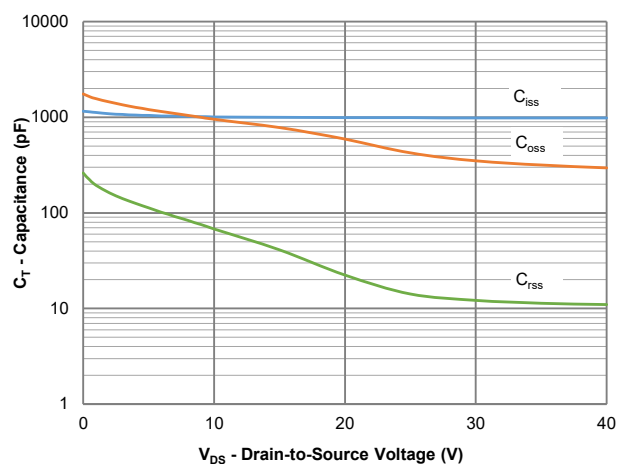
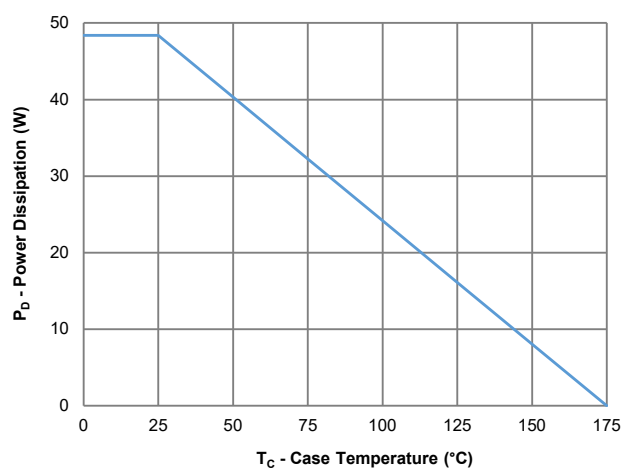
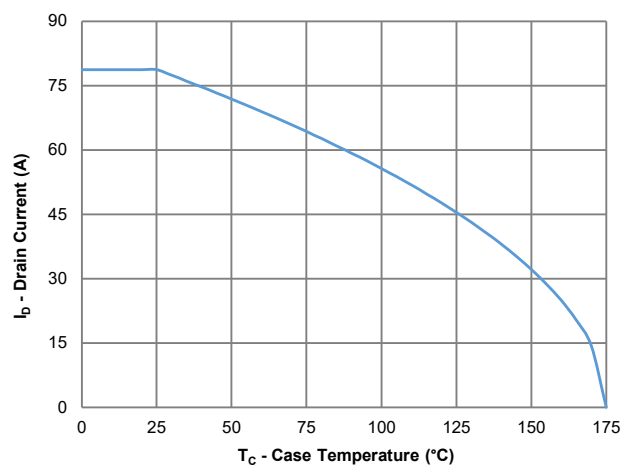
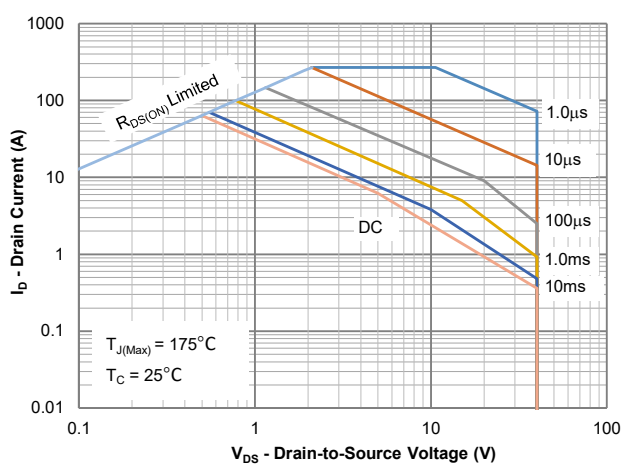
**Electrical Characteristics (Chip-1 & Chip-2) (@  $T_J = 25^\circ\text{C}$ , unless otherwise specified.)**

| 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> = 20A                                                   | -    | 3.6  | 4.4  | mΩ   |
| Forward Transconductance                          | g <sub>fs</sub>      | V <sub>DS</sub> = 5.0V, I <sub>D</sub> = 20A                                                  | -    | 21   | -    | 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                                         | -    | 989  | 1286 | pF   |
| Output Capacitance                                | C <sub>oss</sub>     |                                                                                               | -    | 589  | 766  | pF   |
| Reverse Transfer Capacitance                      | C <sub>rss</sub>     |                                                                                               | -    | 22   | 44   | pF   |
| Gate Resistance                                   | R <sub>g</sub>       | V <sub>GS</sub> = 0V, V <sub>DS</sub> = 0V, f = 1MHz                                          | -    | 3.2  | -    | 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> = 20A, R <sub>GEN</sub> = 3.0Ω | -    | 3.0  | -    | ns   |
| Rise Time                                         | t <sub>r</sub>       |                                                                                               | -    | 4.3  | -    | ns   |
| Turn-Off DelayTime                                | t <sub>d(off)</sub>  |                                                                                               | -    | 12   | -    | ns   |
| Fall Time                                         | t <sub>f</sub>       |                                                                                               | -    | 4.9  | -    | 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> = 20A<br>V <sub>GS</sub> = 10V                          | -    | 13.7 | 17.8 | nC   |
| Total Gate Charge (V <sub>GS</sub> = 7.0V)        | Q <sub>g</sub>       |                                                                                               | -    | 9.9  | 12.9 | nC   |
| Gate-Source Charge                                | Q <sub>gs</sub>      |                                                                                               | -    | 4.4  | 6.6  | nC   |
| Gate-Drain Charge                                 | Q <sub>gd</sub>      |                                                                                               | -    | 2.4  | 3.6  | nC   |
| Gate Plateau Voltage                              | V <sub>plateau</sub> |                                                                                               | -    | 4.6  | -    | 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,<br>T <sub>J</sub> = 25°C                               | -    | 29   | -    | ns   |
| Body Diode Reverse Recovery Charge                | Q <sub>rr</sub>      |                                                                                               | -    | 15   | -    | nC   |
| Diode Forward Current                             | I <sub>S</sub>       | T <sub>C</sub> = 25°C                                                                         | -    | -    | 38   | 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(Chip-1 & Chip-2)**

**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(Chip-1 & Chip-2)**

**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(Chip-1 &amp; Chip-2)

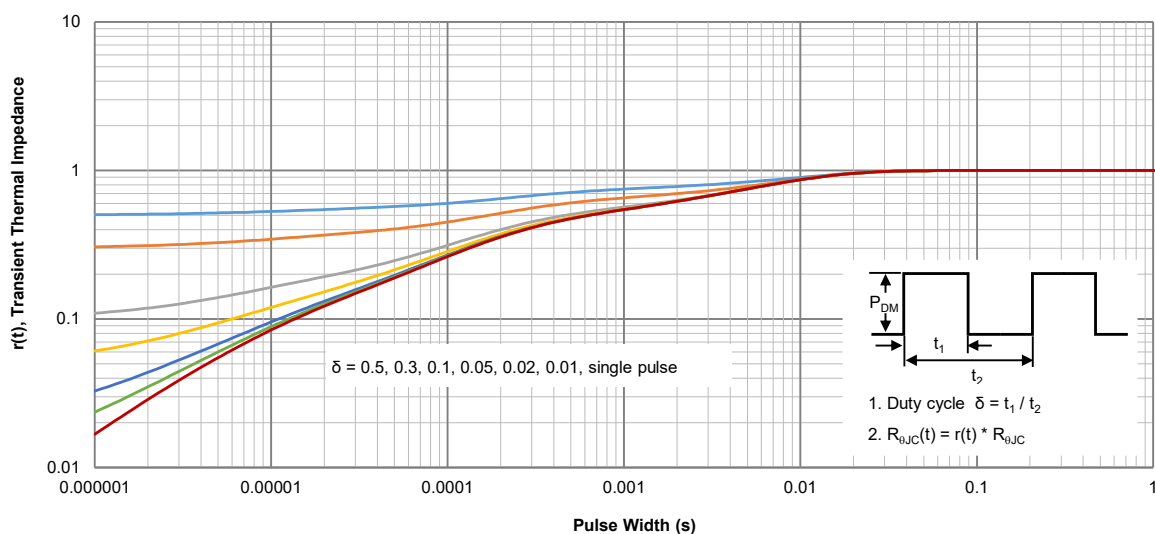
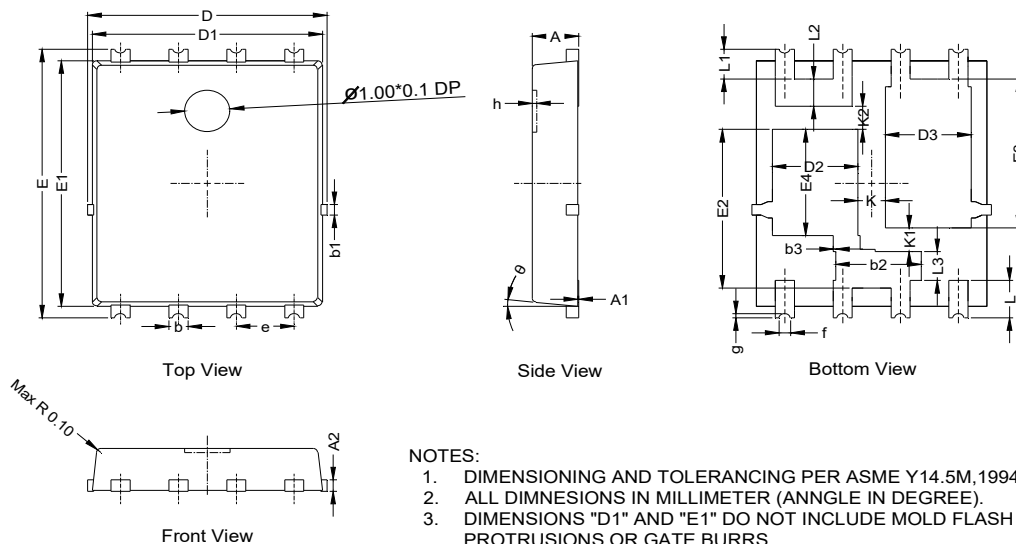


Figure 13: Normalized Maximum Transient Thermal Impedance

**PDFN5060-8L-HW Package Outline**
**Package Outline**

**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. ALL DIMENSIONS IN MILLIMETER (ANGLE IN DEGREE).
3. DIMENSIONS "D1" AND "E1" DO NOT INCLUDE MOLD FLASH PROTRUSIONS OR GATE BURRS.

| DIM. | MILLIMETER |      |      |
|------|------------|------|------|
|      | MIN.       | NOM. | MAX. |
| A    | 0.90       | 1.00 | 1.10 |
| A1   | 0.00       | 0.02 | 0.05 |
| A2   | 0.21       | 0.25 | 0.34 |
| b    | 0.32       | 0.42 | 0.52 |
| b1   | 0.15       | 0.25 | 0.35 |
| b2   | 1.78       | 1.88 | 1.98 |
| b3   | 0.05 REF   |      |      |
| D    | 5.05       | 5.20 | 5.40 |
| D1   | 4.95       | 5.05 | 5.15 |
| D2   | 1.78       | 1.88 | 1.98 |
| D3   | 1.78       | 1.88 | 1.98 |
| E    | 6.30       | 6.40 | 6.50 |
| E1   | 5.75       | 5.85 | 5.95 |
| E2   | 3.68       | 3.78 | 3.88 |
| E3   | 3.45       | 3.55 | 3.65 |
| E4   | 2.43       | 2.53 | 2.63 |
| e    | 1.27 BSC   |      |      |
| f    | 0.257 REF  |      |      |
| g    | 0.100 REF  |      |      |
| h    | --         | --   | 0.10 |
| K    | 0.60 REF   |      |      |
| K1   | 0.56 REF   |      |      |
| K2   | 0.55 REF   |      |      |
| L    | 0.79       | 0.89 | 0.99 |
| L1   | 0.61       | 0.71 | 0.81 |
| L2   | 0.55       | 0.65 | 0.75 |
| L3   | 0.59       | 0.69 | 0.79 |
| θ    | 2°         | --   | 10°  |

**Recommended Soldering Footprint**
