



YOUSHANG SEMICONDUCTOR

**设计研发新型功率器件**

**各类小信号开关**

**中低压及高压大电流等场效应管**

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企业微信二维码



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## Product Summary

| BV <sub>DSS</sub> | R <sub>DS(ON)</sub> Max         | I <sub>D</sub> Max<br>T <sub>A</sub> = +25°C |
|-------------------|---------------------------------|--|
| 60V               | 18mΩ @ V <sub>GS</sub> = 10V    | 9.4A   |
|                   | 27.5mΩ @ V <sub>GS</sub> = 4.5V | 7.6A   |

## Description

This new generation MOSFET is designed to minimize the on-state resistance (R<sub>DS(ON)</sub>), yet maintain superior switching performance, making it ideal for high-efficiency power management applications.

- Power Management Functions
- DC-DC Converters
- Backlighting

U-DFN2020-6 (SWP) (Type F)



Top View



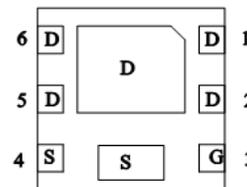
Bottom View

## Features

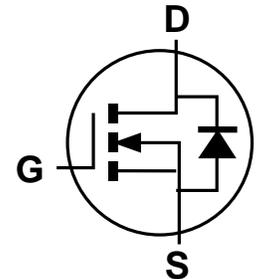
- Rated to +175°C – Ideal for High Ambient Temperature Environments
- 100% Unclamped Inductive Switching – Ensures More Reliable and Robust End Application
- Low R<sub>DS(ON)</sub> – Ensures On State Losses Are Minimized
- 0.6mm Profile – Ideal for Low Profile Applications
- PCB Footprint of 4mm<sup>2</sup>

## Mechanical Data

- Case: U-DFN2020-6 (SWP) (Type F)
- Case Material: Molded Plastic, “Green” Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish - Matte Tin Annealed over Copper Leadframe; Solderable per MIL-STD-202, Method 208 ⑧③
- Weight: 0.007 grams (Approximate)



Pin Out  
Bottom View



Internal Schematic

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

| Characteristic  | Symbol    | Value                      | Unit |   |
|---|-----------|----------------------------|------|---|
| Drain-Source Voltage  | $V_{DSS}$ | 60                         | V    |   |
| Gate-Source Voltage   | $V_{GSS}$ | $\pm 20$                   | V    |   |
| Continuous Drain Current (Note 6) $V_{GS} = 10\text{V}$                     | $I_D$     | $T_A = +25^\circ\text{C}$  | 9.4  | A |
|   |           | $T_A = +100^\circ\text{C}$ | 6.6  | A |
| Pulsed Drain Current (10 $\mu\text{s}$ Pulse, Duty Cycle = 1%)              | $I_{DM}$  | 70                         | A    |   |
| Continuous Source-Drain Diode Current (Note 6)                              | $I_S$     | 3.0                        | A    |   |
| Pulsed Source-Drain Diode Current (10 $\mu\text{s}$ Pulse, Duty Cycle = 1%) | $I_{SM}$  | 70                         | A    |   |
| Avalanche Current, $L = 0.1\text{mH}$ (Note 7)                              | $I_{AS}$  | 15.3                       | A    |   |
| Avalanche Energy, $L = 0.1\text{mH}$ (Note 7)                               | $E_{AS}$  | 11.7                       | mJ   |   |

**Thermal Characteristics**

| Characteristic                                   | Symbol          | Value       | Unit               |
|--|-----------------|-------------|--------------------|
| Total Power Dissipation (Note 5)                 | $P_D$           | 1.06        | W                  |
| Thermal Resistance, Junction to Ambient (Note 5) | $R_{\theta JA}$ | 141         | $^\circ\text{C/W}$ |
| Total Power Dissipation (Note 6)                 | $P_D$           | 2.3         | W                  |
| Thermal Resistance, Junction to Ambient (Note 6) | $R_{\theta JA}$ | 63          | $^\circ\text{C/W}$ |
| Thermal Resistance, Junction to Case (Note 6)    | $R_{\theta JC}$ | 9.6         | $^\circ\text{C/W}$ |
| Operating and Storage Temperature Range          | $T_J, T_{STG}$  | -55 to +175 | $^\circ\text{C}$   |

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

| Characteristic                               | Symbol       | Min | Typ  | Max       | Unit          | Test Condition  |
|--|--------------|-----|------|-----------|---------------|---|
| <b>OFF CHARACTERISTICS</b> (Note 8)          |              |     |      |           |               |   |
| Drain-Source Breakdown Voltage               | $BV_{DSS}$   | 60  | —    | —         | V             | $V_{GS} = 0\text{V}, I_D = 250\mu\text{A}$                                  |
| Zero Gate Voltage Drain Current              | $I_{DSS}$    | —   | —    | 1         | $\mu\text{A}$ | $V_{DS} = 48\text{V}, V_{GS} = 0\text{V}$                                   |
| Gate-Source Leakage                          | $I_{GSS}$    | —   | —    | $\pm 100$ | nA            | $V_{GS} = \pm 20\text{V}, V_{DS} = 0\text{V}$                               |
| <b>ON CHARACTERISTICS</b> (Note 8)           |              |     |      |           |               |   |
| Gate Threshold Voltage                       | $V_{GS(TH)}$ | 1   | —    | 3         | V             | $V_{DS} = V_{GS}, I_D = 250\mu\text{A}$                                     |
| Static Drain-Source On-Resistance            | $R_{DS(ON)}$ | —   | 13.8 | 18        | m $\Omega$    | $V_{GS} = 10\text{V}, I_D = 10\text{A}$                                     |
|  |              |     | 20.3 | 27.5      |               | $V_{GS} = 4.5\text{V}, I_D = 6\text{A}$                                     |
| Diode Forward Voltage                        | $V_{SD}$     | —   | —    | 1.0       | V             | $V_{GS} = 0\text{V}, I_S = 10\text{A}$                                      |
| <b>DYNAMIC CHARACTERISTICS</b> (Note 9)      |              |     |      |           |               |   |
| Input Capacitance                            | $C_{iss}$    | —   | 925  | —         | pF            | $V_{DS} = 30\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$                  |
| Output Capacitance                           | $C_{oss}$    | —   | 242  | —         |               |   |
| Reverse Transfer Capacitance                 | $C_{rss}$    | —   | 25.4 | —         |               |   |
| Gate Resistance                              | $R_g$        | —   | 1.3  | —         | $\Omega$      | $V_{DS} = 0\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$                   |
| Total Gate Charge ( $V_{GS} = 4.5\text{V}$ ) | $Q_g$        | —   | 7.5  | —         | nC            | $V_{DS} = 30\text{V}, I_D = 10\text{A}$                                     |
| Total Gate Charge ( $V_{GS} = 10\text{V}$ )  | $Q_g$        | —   | 15.3 | —         |               |   |
| Gate-Source Charge                           | $Q_{gs}$     | —   | 2.6  | —         |               |   |
| Gate-Drain Charge                            | $Q_{gd}$     | —   | 3.5  | —         |               |   |
| Turn-On Delay Time                           | $t_{D(ON)}$  | —   | 3.2  | —         | ns            | $V_{GS} = 10\text{V}, V_{DS} = 30\text{V}, R_g = 6\Omega, I_D = 10\text{A}$ |
| Turn-On Rise Time                            | $t_R$        | —   | 4.2  | —         |               |   |
| Turn-Off Delay Time                          | $t_{D(OFF)}$ | —   | 14.5 | —         |               |   |
| Turn-Off Fall Time                           | $t_F$        | —   | 7.2  | —         |               |   |
| Reverse Recovery Time                        | $t_{RR}$     | —   | 20.8 | —         | ns            | $I_F = 10\text{A}, di/dt = 100\text{A}/\mu\text{s}$                         |
| Reverse Recovery Charge                      | $Q_{RR}$     | —   | 11.4 | —         | nC            |   |

- Notes:
- Device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.
  - Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.
  - $I_{AS}$  and  $E_{AS}$  ratings are based on low frequency and duty cycles to keep  $T_J = +25^\circ\text{C}$ .
  - Short duration pulse test used to minimize self-heating effect.
  - Guaranteed by design. Not subject to product testing.

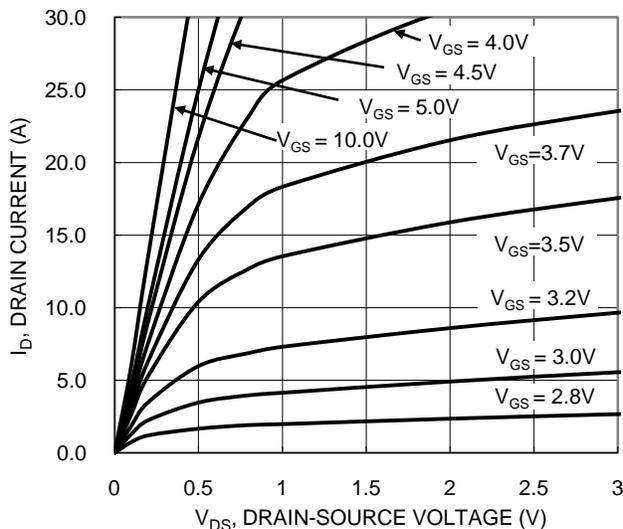


Figure 1. Typical Output Characteristic

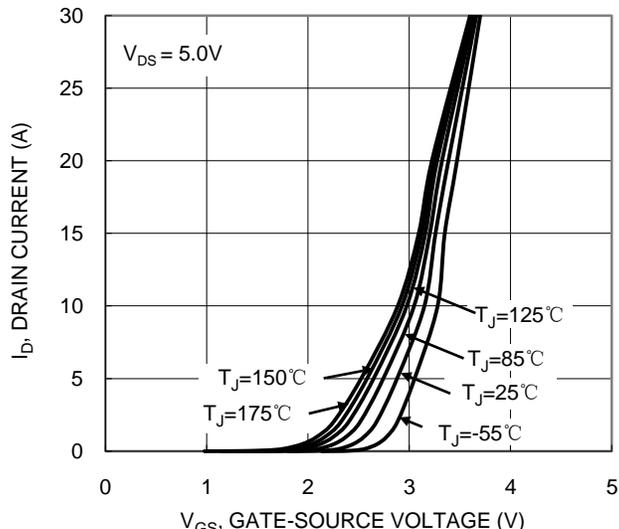


Figure 2. Typical Transfer Characteristic

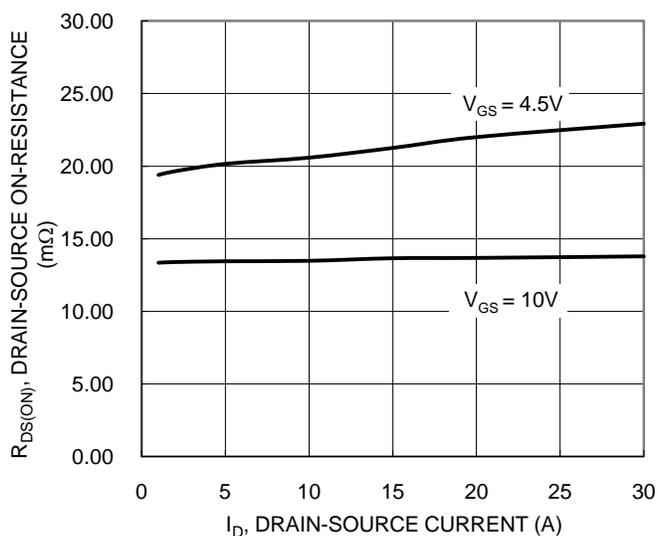


Figure 3. Typical On-Resistance vs. Drain Current and Gate Voltage

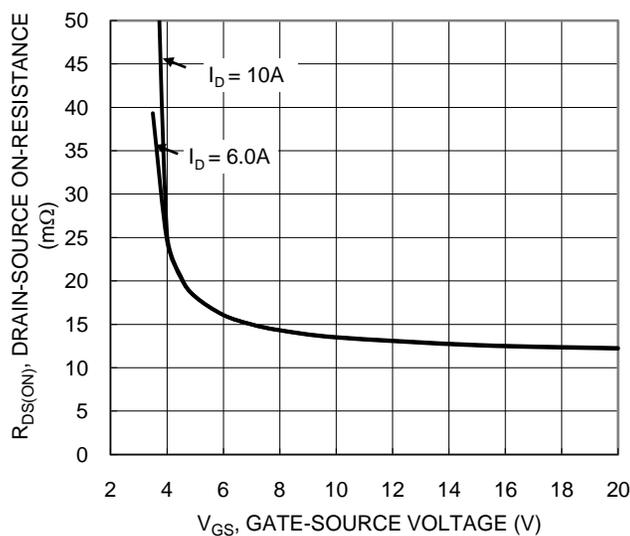


Figure 4. Typical Transfer Characteristic

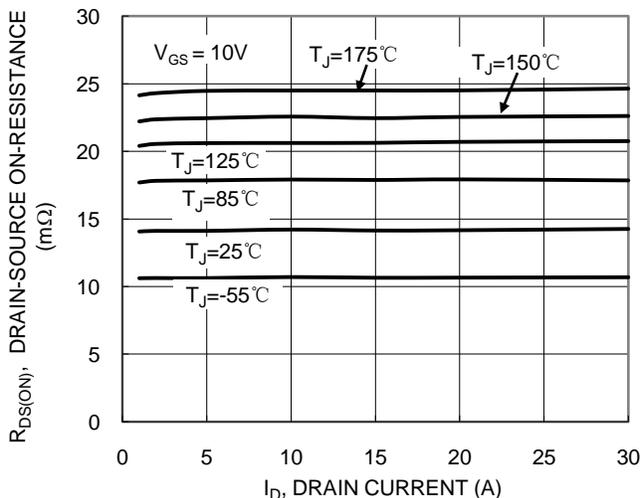


Figure 5. Typical On-Resistance vs. Drain Current and Temperature

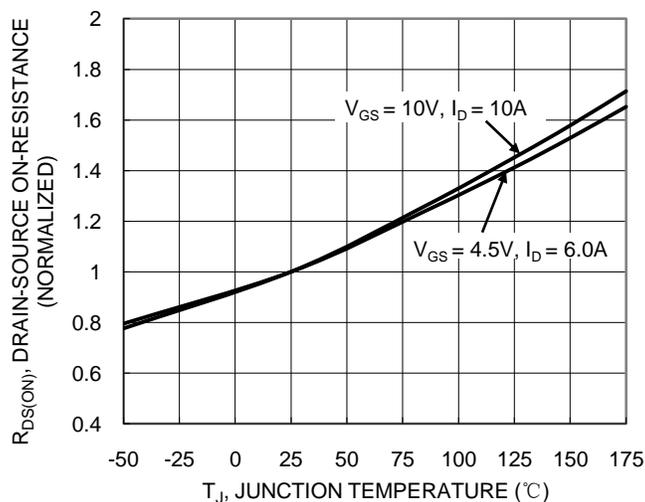


Figure 6. On-Resistance Variation with Temperature

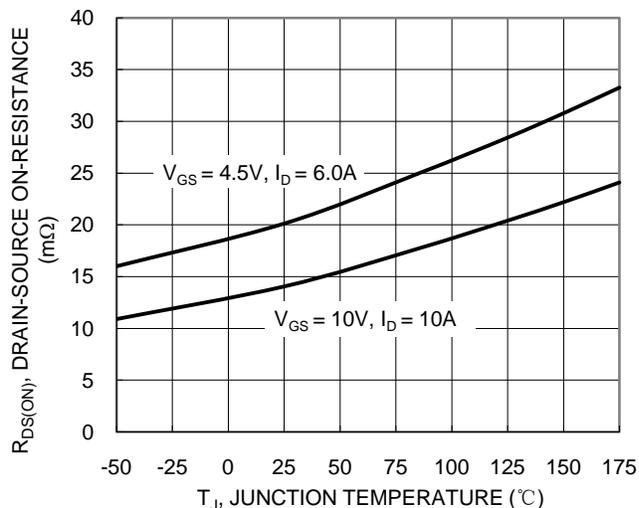


Figure 7. On-Resistance Variation with Temperature

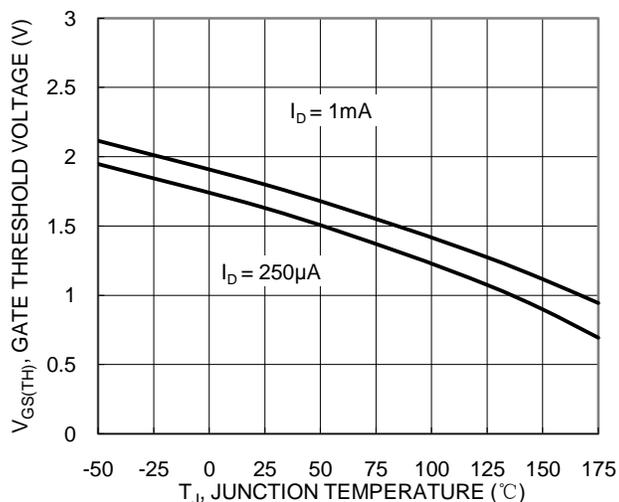


Figure 8. Gate Threshold Variation vs. Junction Temperature

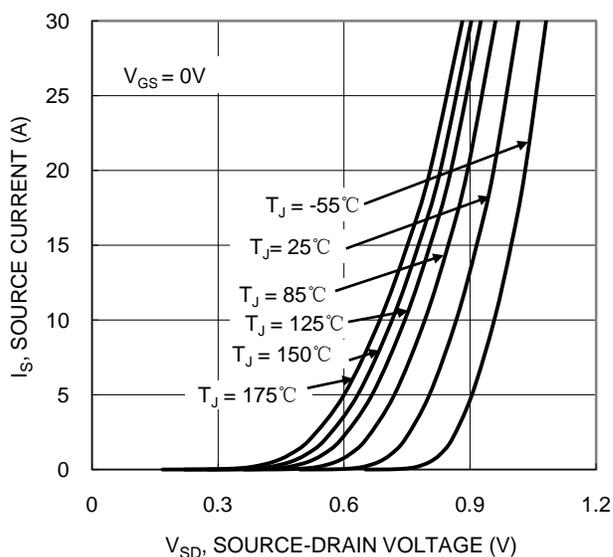


Figure 9. Diode Forward Voltage vs. Current

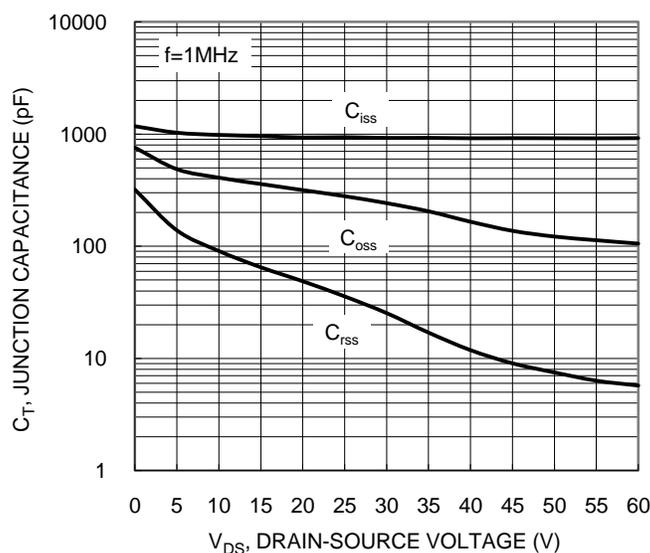


Figure 10. Typical Junction Capacitance

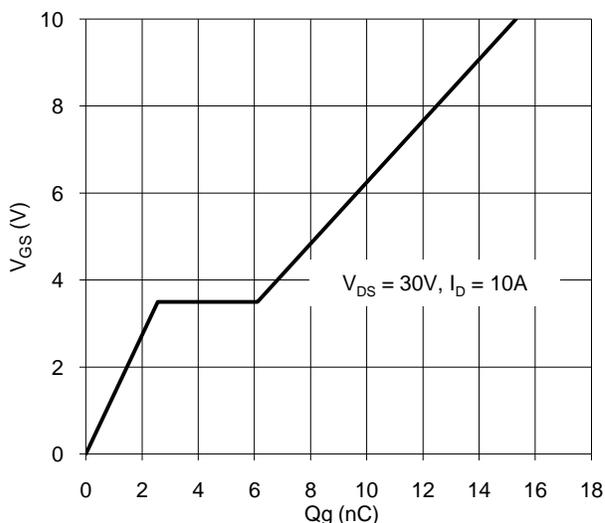


Figure 11. Gate Charge

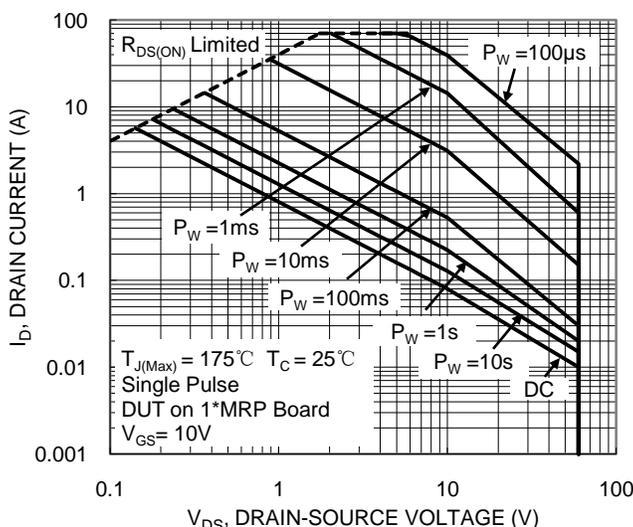
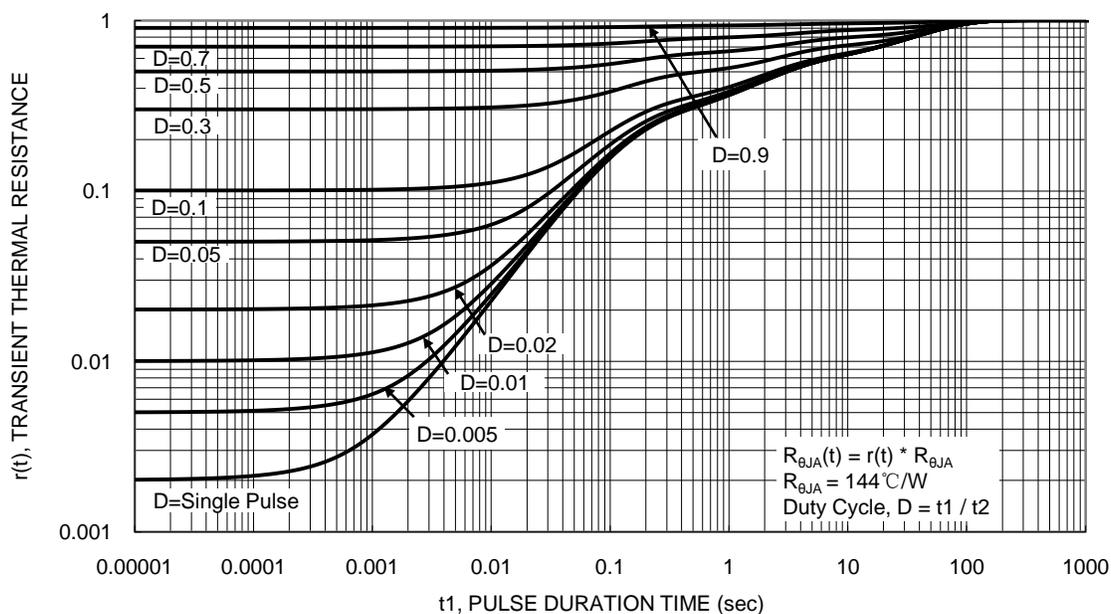
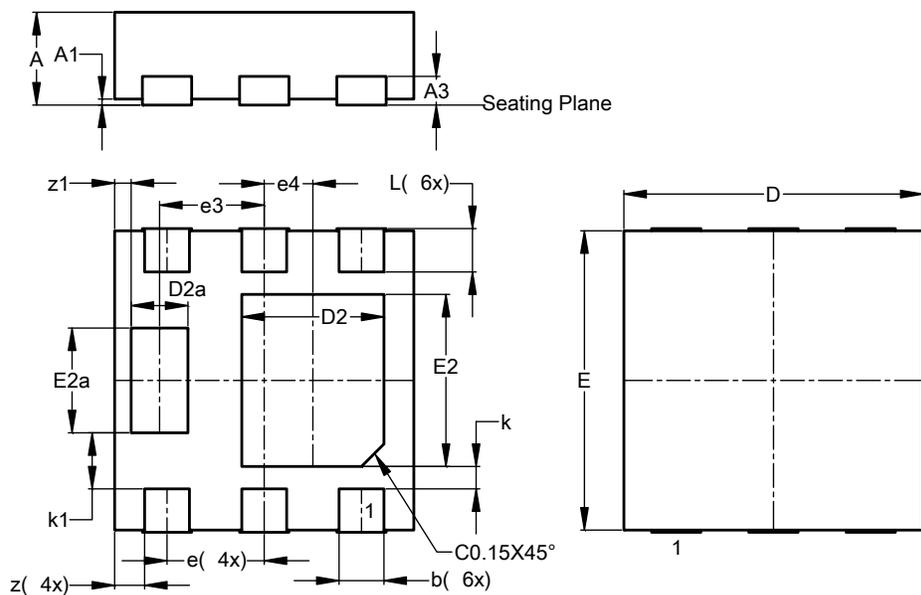


Figure 12. SOA, Safe Operation Area



### Package Outline Dimensions

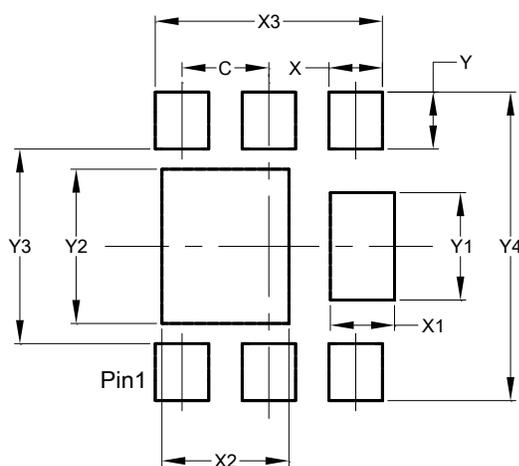
U-DFN2020-6 (SWP) (Type F)



| U-DFN2020-6 (SWP)<br>(Type F) |           |       |       |
|-------------------------------|-----------|-------|-------|
| Dim                           | Min       | Max   | Typ   |
| A                             | 0.59      | 0.65  | 0.62  |
| A1                            | 0.00      | 0.05  | 0.03  |
| A3                            | --        | --    | 0.192 |
| b                             | 0.28      | 0.38  | 0.33  |
| D                             | 1.95      | 2.05  | 2.00  |
| D2                            | 0.87      | 1.07  | 0.97  |
| D2a                           | 0.35      | 0.45  | 0.40  |
| E                             | 1.95      | 2.05  | 2.00  |
| E2                            | 1.07      | 1.27  | 1.17  |
| E2a                           | 0.67      | 0.77  | 0.72  |
| e                             | 0.65 BSC  |       |       |
| e3                            | 0.70 BSC  |       |       |
| e4                            | 0.325 BSC |       |       |
| k                             | --        | --    | 0.15  |
| k1                            | --        | --    | 0.375 |
| L                             | 0.225     | 0.355 | 0.305 |
| z                             | --        | --    | 0.20  |
| z1                            | --        | --    | 0.11  |
| All Dimensions in mm          |           |       |       |

### Suggested Pad Layout

U-DFN2020-6 (SWP) (Type F)



| Dimensions | Value<br>(in mm) |
|------------|------------------|
| C          | 0.650            |
| X          | 0.400            |
| X1         | 0.480            |
| X2         | 0.950            |
| X3         | 1.700            |
| Y          | 0.425            |
| Y1         | 0.800            |
| Y2         | 1.150            |
| Y3         | 1.450            |
| Y4         | 2.300            |