## Product Summary

| $BV_{DSS}$ | $R_{DS(ON)}$ Max | $I_D$ Max $T_C$ = +25°C |
|---|---|---|
| -12V | 15mΩ @ $V_{GS}$ = -4.5V | -20A |
| | 20mΩ @ $V_{GS}$ = -3.7V | -18A |
| | 30mΩ @ $V_{GS}$ = -2.5V | -16A |
| | 40mΩ @ $V_{GS}$ = -1.8V | -11A |

## Description

This new generation MOSFET is designed to minimize the on-state resistance ($R_{DS(ON)}$) and yet maintain superior switching performance, making it ideal for high efficiency power management applications.

## Applications

- Battery Management Application
- Power Management Functions
- DC-DC Converters

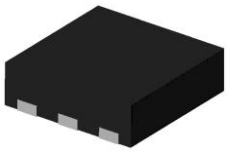
## Features

- 0.6mm Profile – Ideal for Low Profile Applications
- PCB Footprint of 4mm$^2$
- Low On-Resistance
- Fast Switching Speed
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

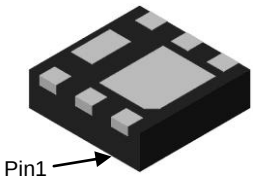
## Mechanical Data

- Case: U-DFN2020-6 (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 – NiPdAu over Copper Leadframe. Solderable per MIL-STD-202, Method 208 e4
- Weight: 0.007 grams (Approximate)

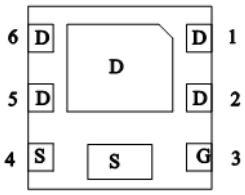
U-DFN2020-6 (Type F)



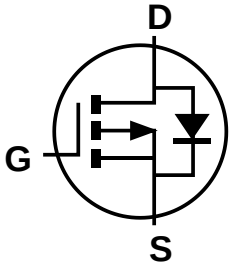
Top View




Bottom View




Pin Out
Bottom View




Internal Schematic

## Ordering Information (Note 4)

| Part Number | Case | Packaging |
|---|---|---|
| DMP1012UFDF-7 | U-DFN2020-6 (Type F) | 3,000/Tape & Reel |
| DMP1012UFDF-13 | U-DFN2020-6 (Type F) | 10,000/Tape & Reel |

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
2. See http://www.diodes.com/quality/lead_free.html for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
4. For packaging details, go to our website at https://www.diodes.com/design/support/packaging/diodes-packaging/.

## Marking Information

PF = Product Type Marking Code
YM = Date Code Marking
Y = Year (ex: F = 2018)
M = Month (ex: 9 = September)

Date Code Key

| Year | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 |
|---|---|---|---|---|---|---|---|---|
| Code | F | G | H | I | J | K | L | M |

| Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Code | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | O | N | D |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## Maximum Ratings (@$T_A$ = +25°C, unless otherwise specified.)

| Characteristic | | | Symbol | Value | Unit |
|---|---|---|---|---|---|
| Drain-Source Voltage | | | $V_{DSS}$ | -12 | V |
| Gate-Source Voltage | | | $V_{GSS}$ | ±8 | V |
| Continuous Drain Current $V_{GS}$ = -4.5V (Note 10) | Steady State | $T_C$ = +25°C<br>$T_C$ = +70°C | $I_D$ | -20<br>-16 | A |
| | t<5s (Note 6) | $T_A$ = +25°C | $I_D$ | -12.6 | A |
| Pulsed Drain Current (10µs Pulse, Duty Cycle = 1%) | | | $I_{DM}$ | -55 | A |
| Maximum Body Diode Continuous Current (Note 6) | | | $I_S$ | -2.8 | A |
| Avalanche Current (Note 7), L = 0.1mH | | | $I_{AS}$ | -21 | A |
| Avalanche Energy (Note 7,) L = 0.1mH | | | $E_{AS}$ | 22 | mJ |

## Thermal Characteristics

| Characteristic | | Symbol | Value | Unit |
|---|---|---|---|---|
| Total Power Dissipation (Note 5) | $T_A$ = +25°C | $P_D$ | 0.72 | W |
| | $T_A$ = +70°C | | 0.46 | |
| Thermal Resistance, Junction to Ambient (Note 5) | Steady State | $R_{\theta JA}$ | 172 | °C/W |
| | t<5s | | 130 | |
| Total Power Dissipation (Note 6) | $T_A$ = +25°C | $P_D$ | 2.11 | W |
| | $T_A$ = +70°C | | 1.36 | |
| Thermal Resistance, Junction to Ambient (Note 6) | Steady State | $R_{\theta JA}$ | 59 | °C/W |
| | t<5s | | 44 | |
| Thermal Resistance, Junction to Case (Note 6) | Steady State | $R_{\theta JC}$ | 9.0 | |
| Operating and Storage Temperature Range | | $T_J$, $T_{STG}$ | -55 to +150 | °C |

## Electrical Characteristics (@$T_A$ = +25°C, unless otherwise specified.)

| Characteristic | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS (Note 8)** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | -12 | — | — | V | $V_{GS}$ = 0V, $I_D$ = -250µA |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | — | — | -1 | µA | $V_{DS}$ = -10V, $V_{GS}$ = 0V |
| Gate-Source Leakage | $I_{GSS}$ | — | — | ±100 | nA | $V_{GS}$ = ±8V, $V_{DS}$ = 0V |
| **ON CHARACTERISTICS (Note 8)** | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | -0.3 | -0.5 | -0.9 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = -250µA |
| Static Drain-Source On-Resistance | $R_{DS(ON)}$ | — | 11 | 15 | mΩ | $V_{GS}$ = -4.5V, $I_D$ = -5A |
| | | | 12 | 20 | | $V_{GS}$ = -3.7V, $I_D$ = -5A |
| | | | 15 | 30 | | $V_{GS}$ = -2.5V, $I_D$ = -4A |
| | | | 20 | 40 | | $V_{GS}$ = -1.8V, $I_D$ = -1A |
| Diode Forward Voltage | $V_{SD}$ | — | -0.8 | -1.2 | V | $V_{GS}$ = 0V, $I_S$ = -10A |
| **DYNAMIC CHARACTERISTICS (Note 9)** | | | | | | |
| Input Capacitance | $C_{iss}$ | — | 1344 | — | pF | $V_{DS}$ = -10V, $V_{GS}$ = 0V, f = 1.0MHz |
| Output Capacitance | $C_{oss}$ | — | 342 | — | | |
| Reverse Transfer Capacitance | $C_{rss}$ | — | 297 | — | | |
| Gate Resistance | $R_g$ | — | 15 | — | Ω | $V_{DS}$ = 0V, $V_{GS}$ = 0V, f = 1MHz |
| Total Gate Charge ($V_{GS}$ = -4.5V) | $Q_g$ | — | 19.5 | — | nC | $V_{DS}$ = -6V, $I_D$ = -10A |
| Total Gate Charge ($V_{GS}$ = -8V) | $Q_g$ | — | 31 | — | | |
| Gate-Source Charge | $Q_{gs}$ | — | 2.1 | — | | |
| Gate-Drain Charge | $Q_{gd}$ | — | 7.9 | — | | |
| Turn-On Delay Time | $t_{D(ON)}$ | — | 6.0 | — | ns | $V_{DS}$ = -6V, $V_{GS}$ = -4.5V, $R_g$ = 1Ω, $I_D$ = -8A |
| Turn-On Rise Time | $t_R$ | — | 32 | — | | |
| Turn-Off Delay Time | $t_{D(OFF)}$ | — | 71 | — | | |
| Turn-Off Fall Time | $t_F$ | — | 85 | — | | |
| Reverse Recovery Time | $t_{RR}$ | — | 46 | — | ns | $I_F$ = -12A, di/dt = 500A/µs |
| Reverse Recovery Charge | $Q_{RR}$ | — | 44 | — | nC | |

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


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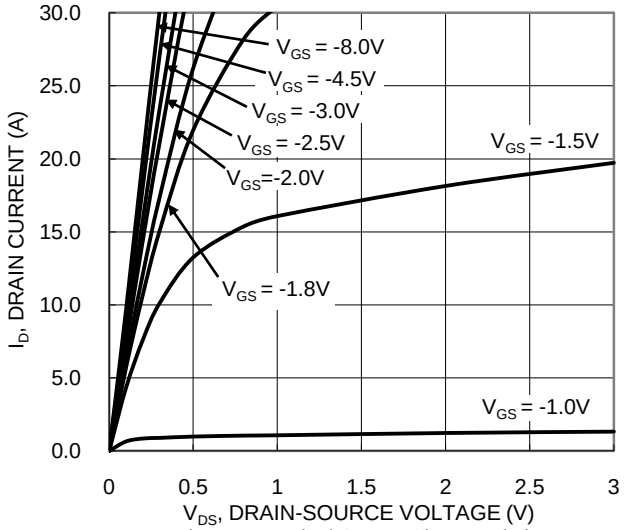


Figure 1. Typical Output Characteristic

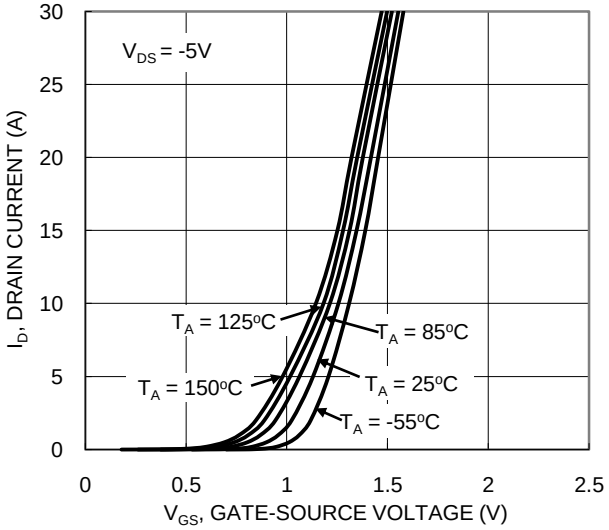


Figure 2. Typical Transfer Characteristic

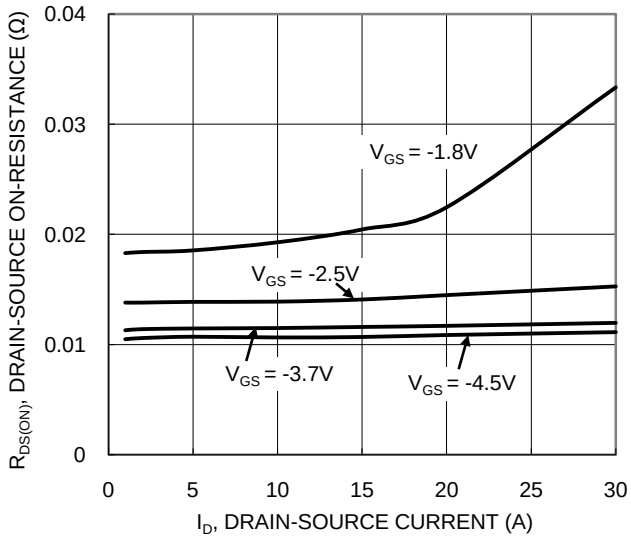


Figure 3. Typical On-Resistance vs. Drain Current and Gate Voltage

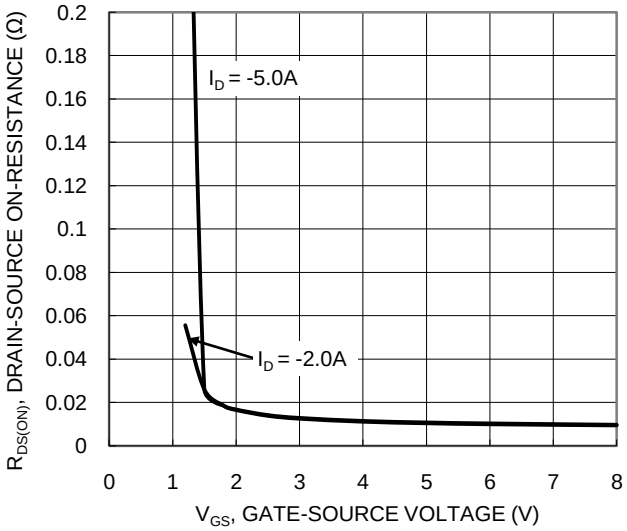


Figure 4. Typical Transfer Characteristic

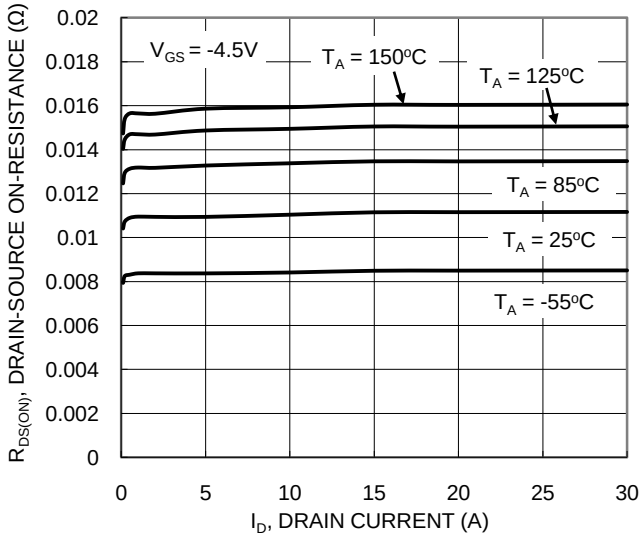


Figure 5. Typical On-Resistance vs. Drain Current and Temperature

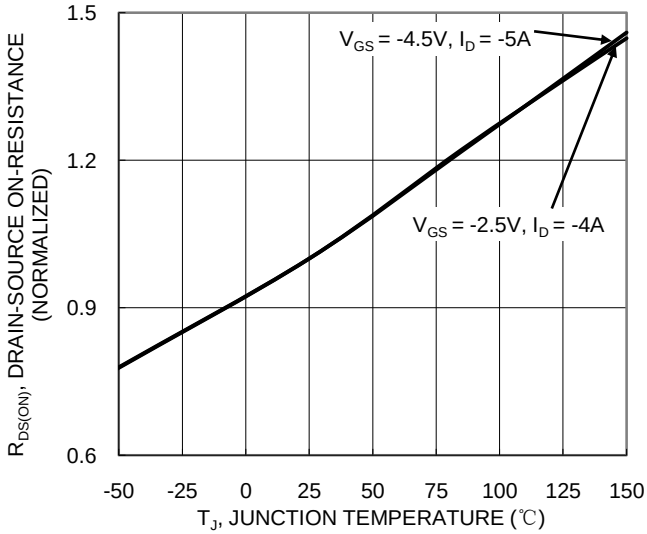


Figure 6. On-Resistance Variation with Temperature


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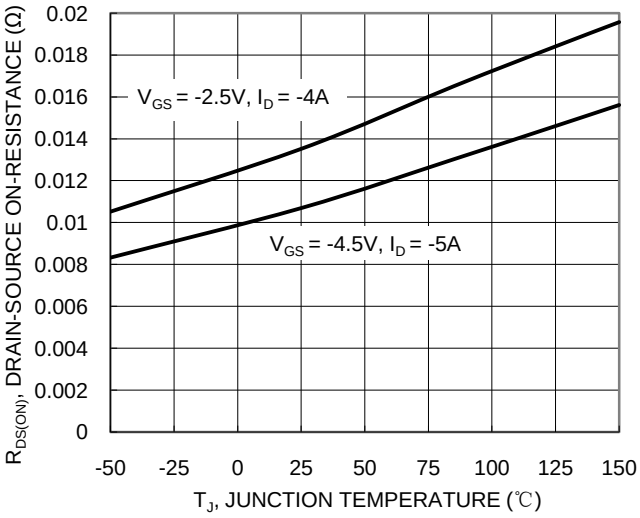

Figure 7. On-Resistance Variation with Temperature

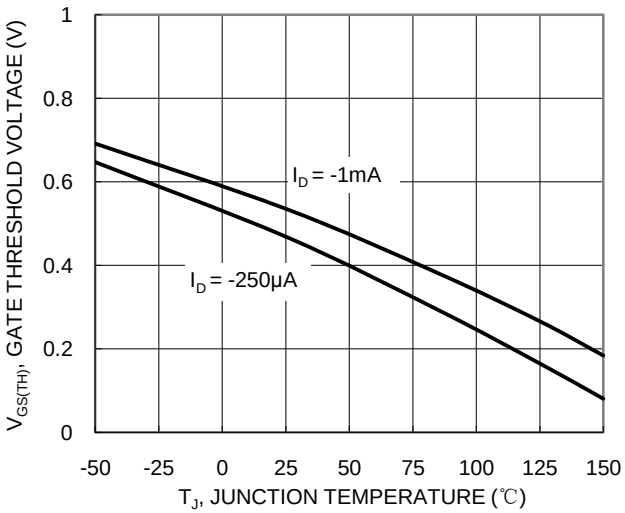

Figure 8. Gate Threshold Variation vs. Junciton Temperature

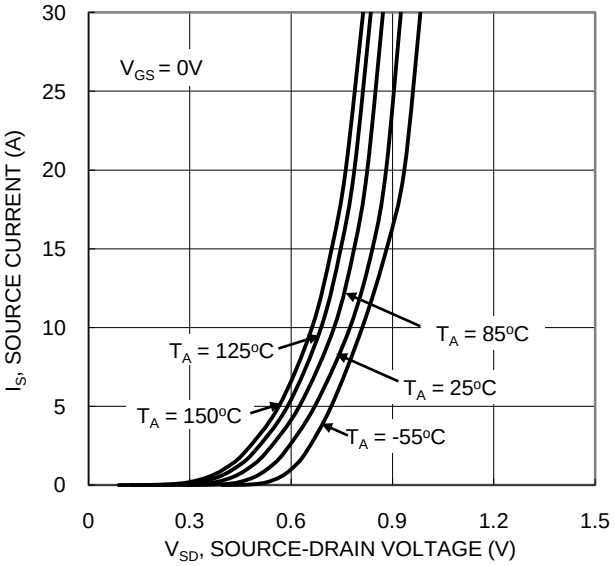

Figure 9. Diode Forward Voltage vs. Current

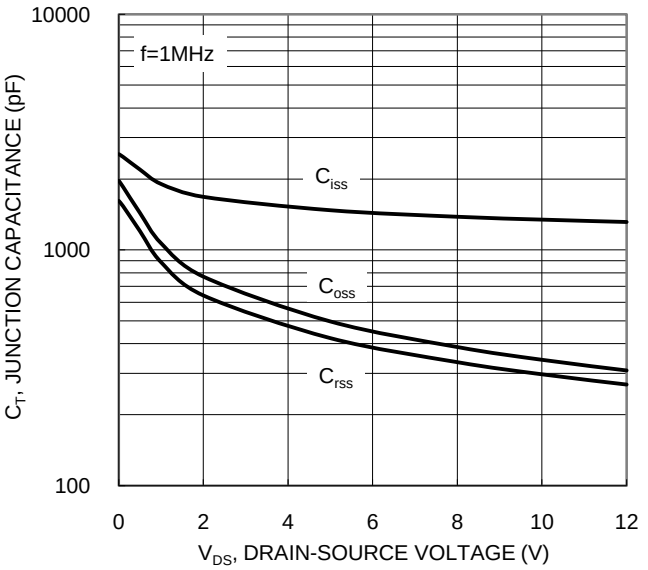

Figure 10. Typical Junction Capacitance

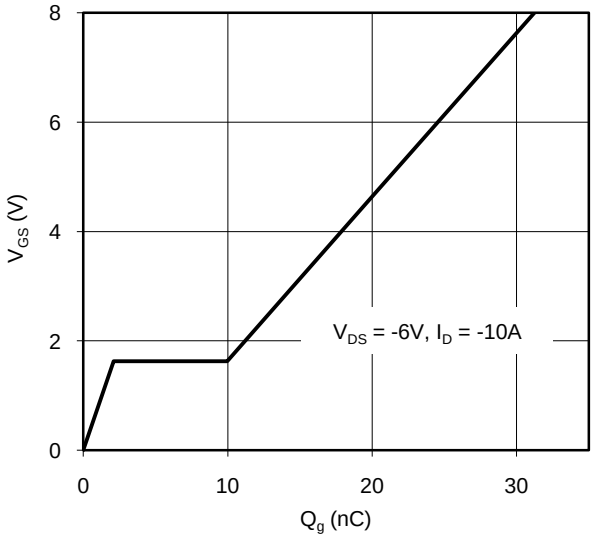

Figure 11. Gate Charge

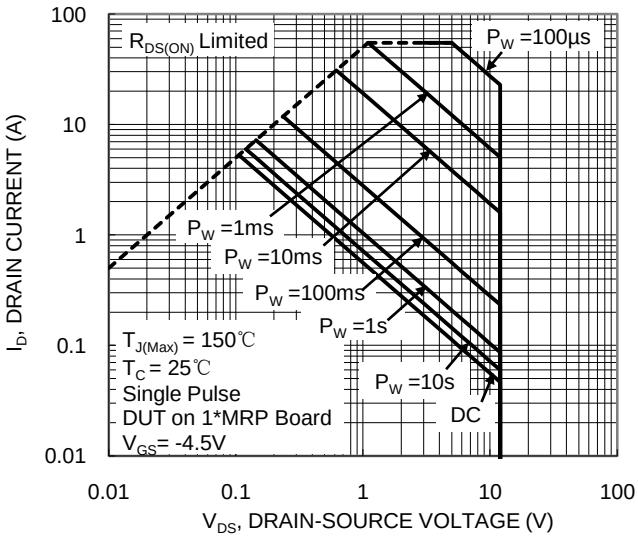

Figure 12. SOA, Safe Operation Area


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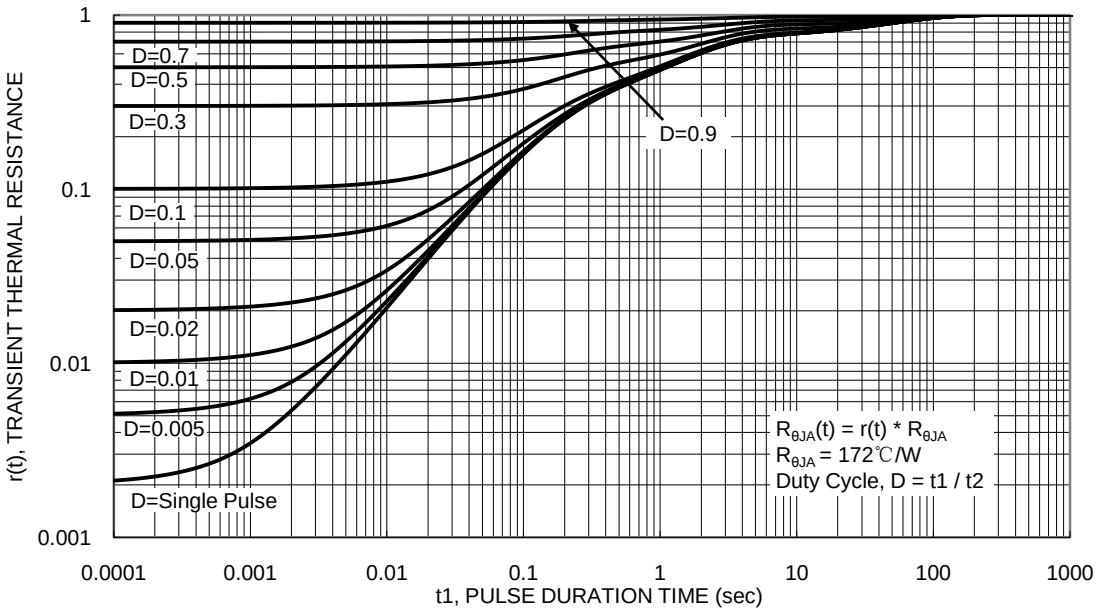


Figure 13. Transient Thermal Resistance


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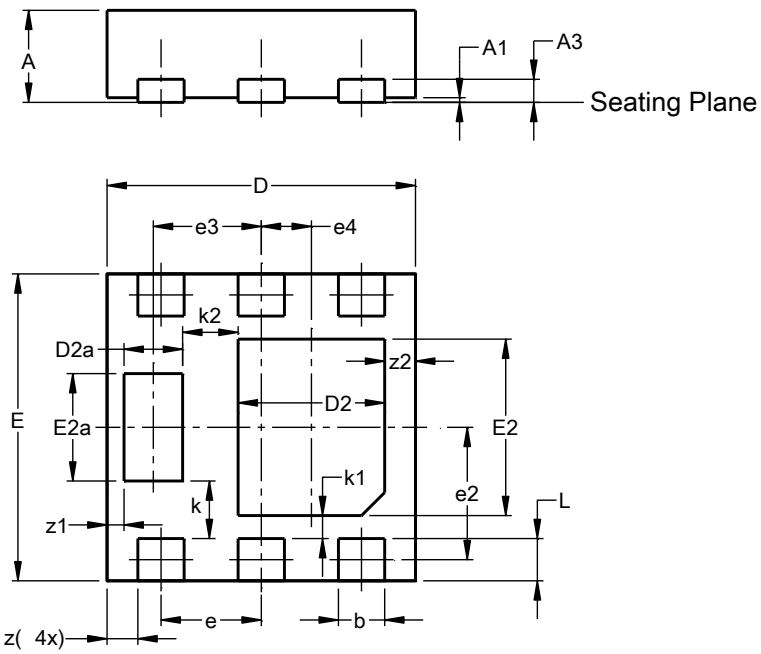
## Package Outline Dimensions

Please see http://www.diodes.com/package-outlines.html for the latest version.

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

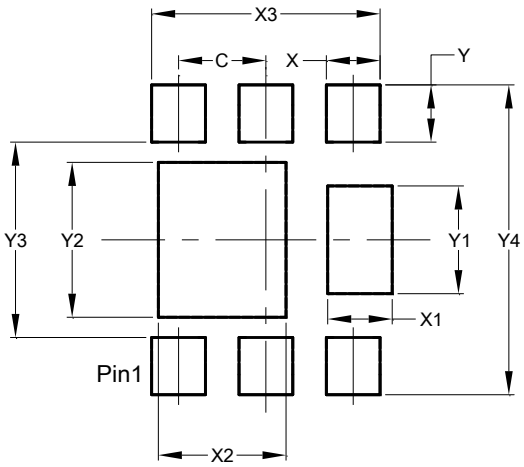



| U-DFN2020-6 (Type F) | | | |
|---|---|---|---|
| **Dim** | **Min** | **Max** | **Typ** |
| **A** | 0.57 | 0.63 | 0.60 |
| **A1** | 0.00 | 0.05 | 0.03 |
| **A3** | - | - | 0.15 |
| **b** | 0.25 | 0.35 | 0.30 |
| **D** | 1.95 | 2.05 | 2.00 |
| **D2** | 0.85 | 1.05 | 0.95 |
| **D2a** | 0.33 | 0.43 | 0.38 |
| **E** | 1.95 | 2.05 | 2.00 |
| **E2** | 1.05 | 1.25 | 1.15 |
| **E2a** | 0.65 | 0.75 | 0.70 |
| **e** | 0.65 BSC | | |
| **e2** | 0.863 BSC | | |
| **e3** | 0.70 BSC | | |
| **e4** | 0.325 BSC | | |
| **k** | 0.37 BSC | | |
| **k1** | 0.15 BSC | | |
| **k2** | 0.36 BSC | | |
| **L** | 0.225 | 0.325 | 0.275 |
| **z** | 0.20 BSC | | |
| **z1** | 0.110 BSC | | |
| **z2** | 0.20 BSC | | |
| **All Dimensions in mm** | | | |

## Suggested Pad Layout

Please see http://www.diodes.com/package-outlines.html for the latest version.

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




| Dimensions | Value (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 |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