

Product Summary

| BV _{DSS} | R _{DS(ON)} Max | I _D Max T _A = +25°C |
|-------------------|--------------------------------|--|
| 12V | 4.8mΩ @ V _{GS} = 4.5V | 15A |
| | 7.0mΩ @ V _{GS} = 2.5V | 12A |

Description

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

Applications

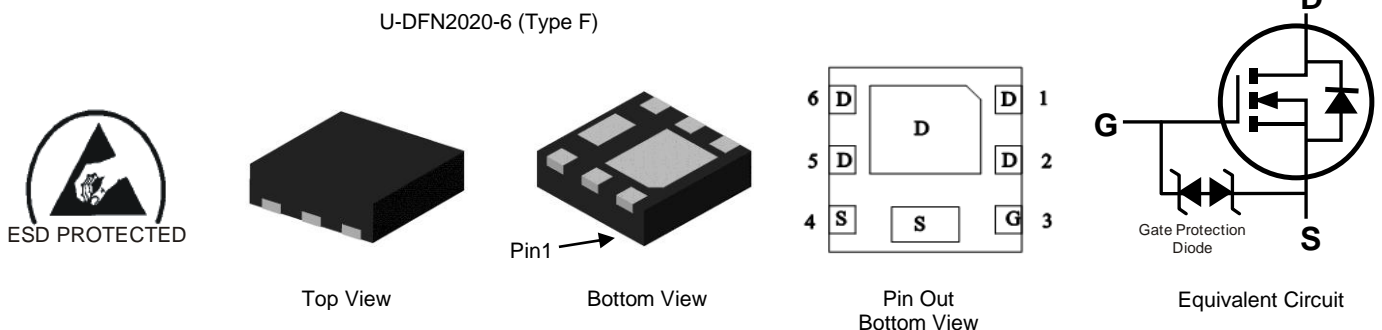
- General Purpose Interfacing Switch
- Power Management Functions

Features

- 0.6mm Profile – Ideal for Low-Profile Applications
- PCB Footprint of 4mm²
- Low Gate Threshold Voltage
- Low On-Resistance
- **ESD Protected Gate**
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. “Green” Device (Note 3)**
- **For automotive applications requiring specific change control (i.e.: parts qualified to AEC-Q100/101/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please refer to the related automotive grade (Q-suffix) part. A listing can be found at <https://www.diodes.com/products/automotive/automotive-products/>.**
- **This part is qualified to JEDEC standards (as references in AEC-Q) for High Reliability. <https://www.diodes.com/quality/product-definitions/>**

Mechanical Data

- Case: U-DFN2020-6
- 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)



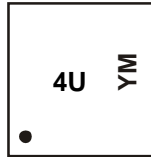
Ordering Information (Note 4)

| Part Number | Case | Packaging |
|----------------|----------------------|--------------------|
| DMN1004UFDF-7 | U-DFN2020-6 (Type F) | 3,000/Tape & Reel |
| DMN1004UFDF-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) & 2015/863/EU (RoHS 3) compliant.
 2. See <https://www.diodes.com/quality/lead-free/> 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

Site 1



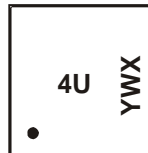
4U = Product Type Marking Code
 YM = Date Code Marking
 Y = Year (ex: H = 2020)
 M = Month (ex: 9 = September)

Date Code Key

| Year | 2016 | ... | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 |
|------|------|-----|------|------|------|------|------|------|------|------|------|------|
| Code | D | ... | H | I | J | K | L | M | N | O | P | R |

| 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 |

Site 2



4U = Product Type Marking Code
 YWX = Date Code Marking
 Y = Year (ex: 0 = 2020)
 W = Week (ex: a = Week 27; z Represents Week 52 and 53)
 X = Internal Code (ex: U = Monday)

Date Code Key

| Year | 2016 | ... | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 |
|------|------|-----|------|------|------|------|------|------|------|------|------|------|
| Code | 6 | ... | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |

| Week | 1-26 | 27-52 | 53 |
|------|------|-------|----|
| Code | A-Z | a-z | z |

| Internal Code | Sun | Mon | Tue | Wed | Thu | Fri | Sat |
|---------------|-----|-----|-----|-----|-----|-----|-----|
| Code | T | U | V | W | X | Y | Z |

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 (Note 6) V _{GS} = 4.5V | Steady State | T _A = +25°C | I _D | 15 | A |
| | | T _A = +70°C | | 12 | |
| Pulsed Drain Current (380µs Pulse, Duty Cycle = 1%) | | | I _{DM} | 70 | A |
| Maximum Body Diode Continuous Current (Note 6) | | | I _S | 3 | A |
| Avalanche Current (Note 7) L = 0.1mH | | | I _{AS} | 34 | A |
| Avalanche Energy (Note 7) L = 0.1mH | | | E _{AS} | 55 | mJ |

Thermal Characteristics

| Characteristic | | Symbol | Value | Unit |
|--|------------------------|-----------------------------------|-------------|------|
| Total Power Dissipation (Note 5) | T _A = +25°C | P _D | 0.9 | W |
| Thermal Resistance, Junction to Ambient (Note 5) | Steady State | R _{θJA} | 167 | °C/W |
| Total Power Dissipation (Note 6) | T _A = +25°C | P _D | 2.1 | W |
| Thermal Resistance, Junction to Ambient (Note 6) | Steady State | R _{θJA} | 72 | °C/W |
| Thermal Resistance, Junction to Case (Note 6) | | R _{θJC} | 22 | |
| 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 T _J = +25°C | I _{DSS} | — | — | 1 | µA | V _{DS} = 9.6V, V _{GS} = 0V |
| Gate-Source Leakage | I _{GSS} | — | — | ±10 | µA | V _{GS} = ±8V, V _{DS} = 0V |
| ON CHARACTERISTICS (Note 8) | | | | | | |
| Gate Threshold Voltage | V _{GS(TH)} | 0.3 | — | 1.0 | V | V _{DS} = V _{GS} , I _D = 250µA |
| Static Drain-Source On-Resistance | R _{DS(ON)} | — | 4.1 | 4.8 | mΩ | V _{GS} = 4.5V, I _D = 15A |
| | | — | 4.5 | 7.0 | | V _{GS} = 2.5V, I _D = 10A |
| Diode Forward Voltage | V _{SD} | — | 0.6 | 1.2 | V | V _{GS} = 0V, I _S = 3.2A |
| DYNAMIC CHARACTERISTICS (Note 9) | | | | | | |
| Input Capacitance | C _{ISS} | — | 2,385 | — | pF | V _{DS} = 6V, V _{GS} = 0V, f = 1.0MHz |
| Output Capacitance | C _{OSS} | — | 678 | — | pF | |
| Reverse Transfer Capacitance | C _{RSS} | — | 520 | — | pF | |
| Gate Resistance | R _G | — | 2.2 | — | Ω | V _{DS} = 0V, V _{GS} = 0V, f = 1MHz |
| Total Gate Charge (V _{GS} = 4.5V) | Q _G | — | 26 | — | nC | V _{DS} = 6V, I _D = 10A |
| Total Gate Charge (V _{GS} = 10V) | Q _G | — | 47 | — | nC | |
| Gate-Source Charge | Q _{GS} | — | 2.8 | — | nC | |
| Gate-Drain Charge | Q _{GD} | — | 5.3 | — | nC | |
| Turn-On Delay Time | t _{D(ON)} | — | 5.3 | — | ns | V _{DS} = 6V, I _D = 5.0A V _{GS} = 4.5V, R _G = 1.0Ω |
| Turn-On Rise Time | t _R | — | 10.7 | — | ns | |
| Turn-Off Delay Time | t _{D(OFF)} | — | 31.6 | — | ns | |
| Turn-Off Fall Time | t _F | — | 16.9 | — | ns | I _F = 2.0A, di/dt = 100A/µs |
| Reverse Recovery Time | t _{RR} | — | 24.3 | — | ns | |
| Reverse Recovery Charge | Q _{RR} | — | 7.4 | — | nC | |

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

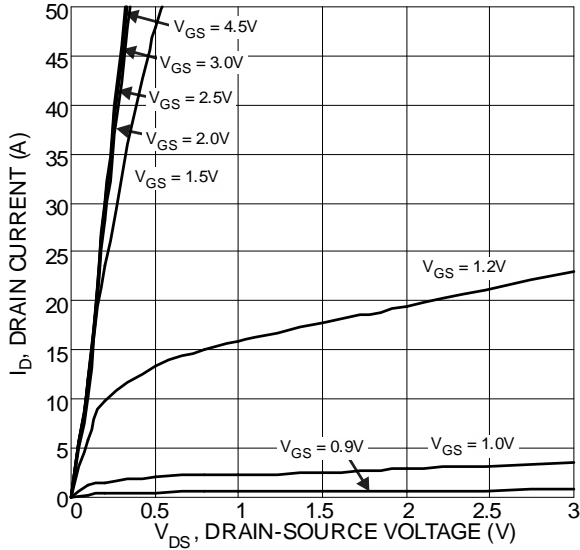


Figure 1 Typical Output Characteristic

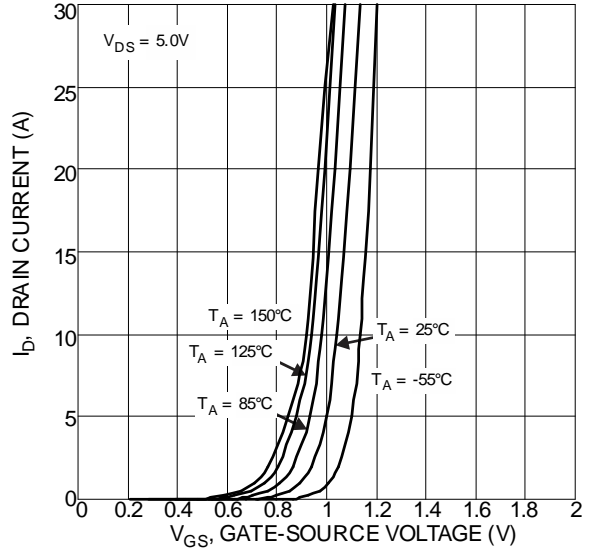


Figure 2 Typical Transfer Characteristics

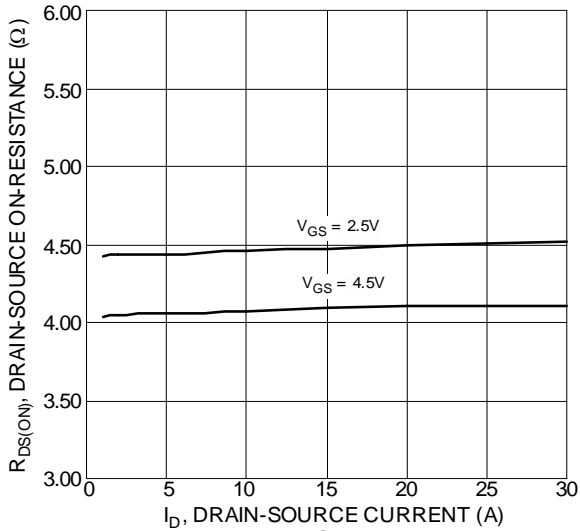


Figure 3 Typical On-Resistance vs. Drain Current and Gate Voltage

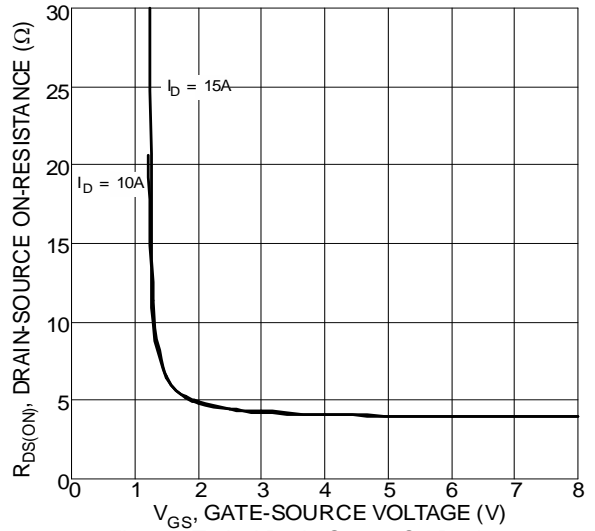


Figure 4 Typical Drain-Source On-Resistance vs. Gate-Source Voltage

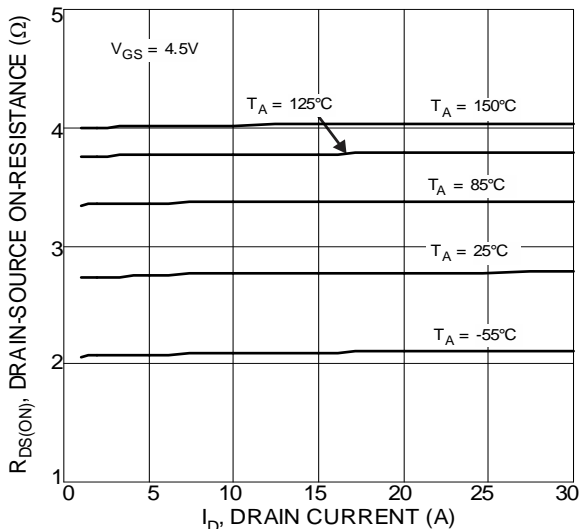


Figure 5 Typical On-Resistance vs. Drain Current and Temperature

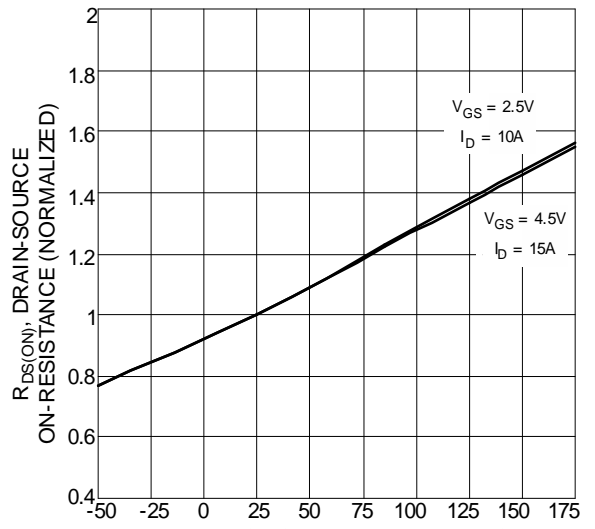


Figure 6 On-Resistance Variation with Temperature

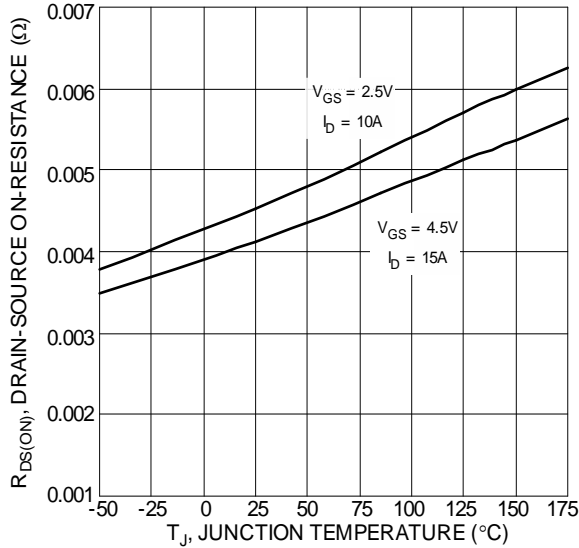


Figure 7 On-Resistance Variation with Temperature

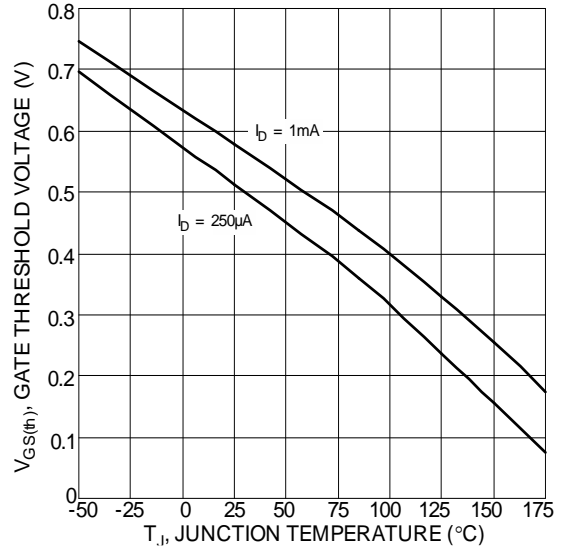


Figure 8 Gate Threshold Variation vs. Junction Temperature

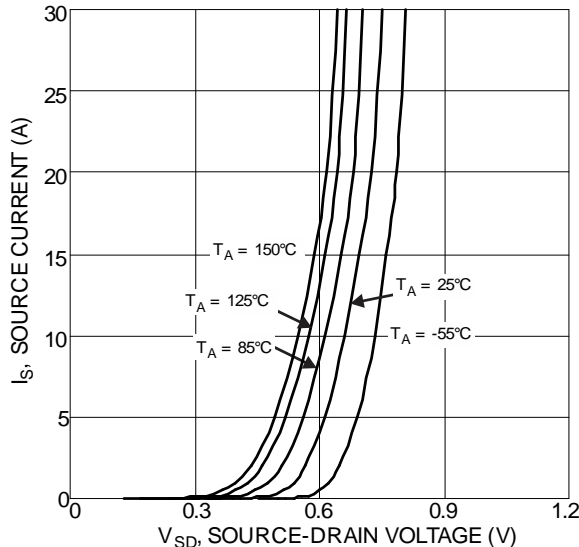


Figure 9 Diode Forward Voltage vs. Current

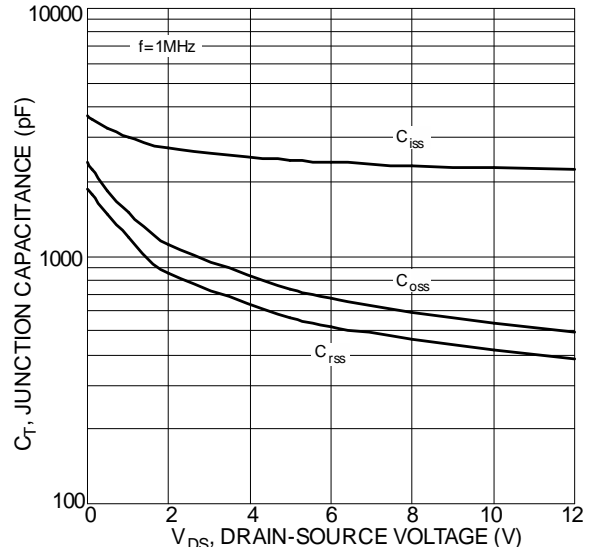


Figure 10 Typical Junction Capacitance

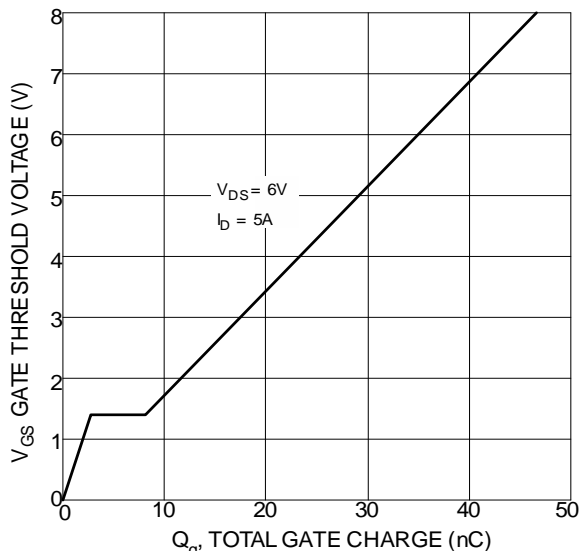


Figure 11 Gate Charge

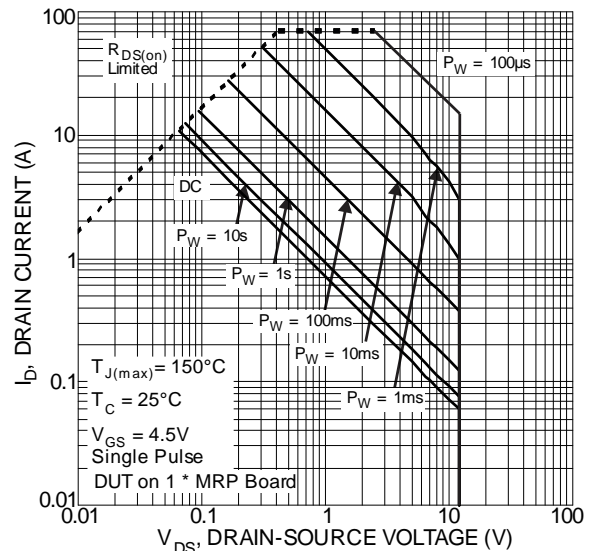
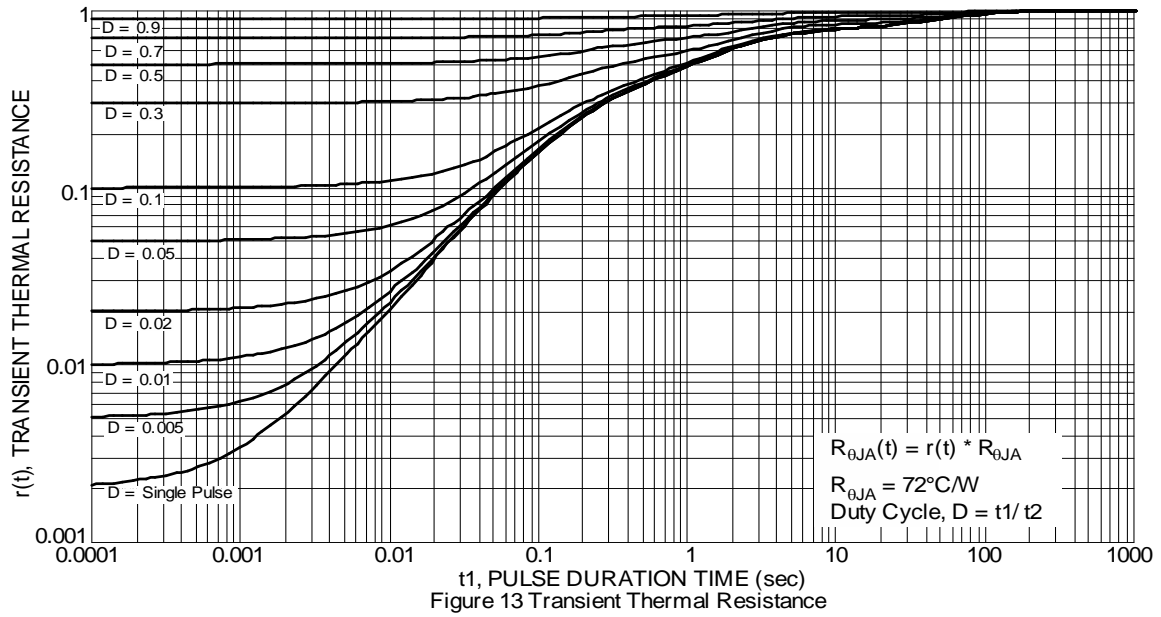


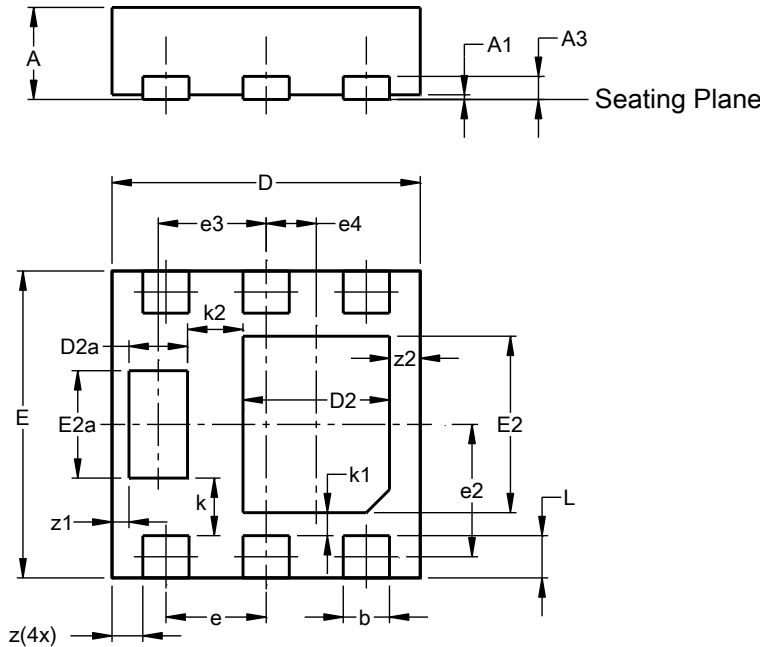
Figure 12 SOA, Safe Operation Area



Package Outline Dimensions

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

U-DFN2020-6 (Type F)

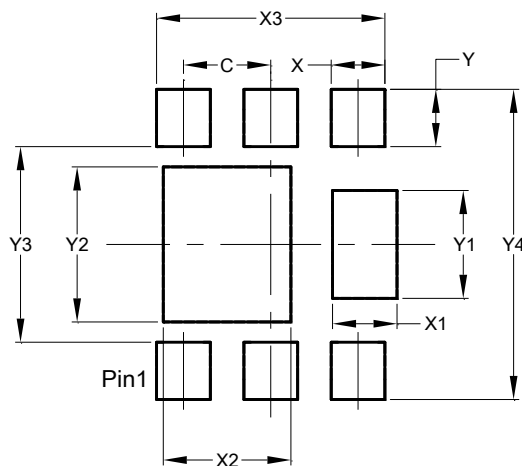


| U-DFN2020-6 (Type F) | | | |
|-----------------------------|-----------|-------|-------|
| Dim | Min | Max | Typ |
| A | 0.57 | 0.63 | 0.60 |
| A1 | 0.00 | 0.05 | 0.03 |
| A3 | - | - | 0.15 |
| b | 0.25 | 0.35 | 0.30 |
| D | 1.95 | 2.05 | 2.00 |
| D2 | 0.85 | 1.05 | 0.95 |
| D2a | 0.33 | 0.43 | 0.38 |
| 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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