

Product Summary

| $V_{(BR)DSS}$ | $R_{DS(ON) \max}$ | Package | $I_{D \max}$ $T_A = +25^\circ\text{C}$ |
|---------------|---------------------------------------|-----------------------|---|
| 60V | 38m Ω @ $V_{GS} = 10\text{V}$ | U-DFN2020-6 Type E | 6.5A |
| | 47m Ω @ $V_{GS} = 4.5\text{V}$ | | 5.2A |

Description

This new generation MOSFET has been 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

- General Purpose Interfacing Switch
- Power Management Functions

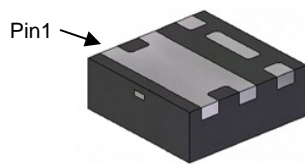
Features and Benefits

- 100% Unclamped Inductive Switch (UIS) test in production
- 0.6mm profile – ideal for low profile applications
- PCB footprint of 4mm²
- Low On-Resistance
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**

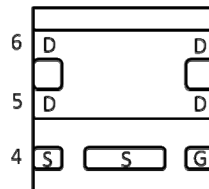
Mechanical Data

- Case: U-DFN2020-6 Type E
- 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
- Weight: 0.0065 grams (approximate)

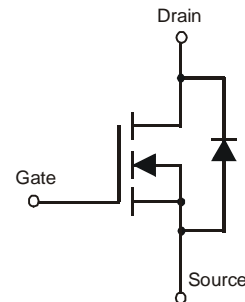
U-DFN2020-6 Type E



Bottom View



Pin Out
Bottom View



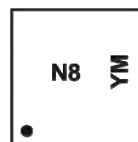
Equivalent Circuit

Ordering Information (Note 4)

| Part Number | Marking | Reel size (inches) | Quantity per reel |
|----------------|---------|--------------------|-------------------|
| DMN6040SFDE-7 | N8 | 7 | 3,000 |
| DMN6040SFDE-13 | N8 | 13 | 10,000 |

- 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> 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 <http://www.diodes.com>.

Marking Information



N8 = Product Type Marking Code
 YM = Date Code Marking
 Y = Year (ex: Y = 2011)
 M = Month (ex: 9 = September)

Date Code Key

| Year | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|------|------|------|------|------|------|------|------|
| Code | Y | Z | A | B | C | D | E |

| 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 |

Maximum Ratings (@T_A = +25°C, unless otherwise specified.)

| Characteristic | Symbol | Value | Units | |
|---|------------------|------------------------|-------|---|
| Drain-Source Voltage | V _{DSS} | 60 | V | |
| Gate-Source Voltage | V _{GSS} | ±20 | V | |
| Continuous Drain Current (Note 6) V _{GS} = 10V | Steady State | T _A = +25°C | 5.3 | A |
| | | T _A = +70°C | 4.1 | |
| Pulsed Drain Current (10µs pulse, duty cycle = 1%) | t < 10s | T _A = +25°C | 6.5 | A |
| | | T _A = +70°C | 5.1 | |
| Maximum Body Diode Continuous Current | I _S | 2.5 | A | |
| Avalanche Current (Note 7) L = 0.1mH | I _{AR} | 14.2 | A | |
| Avalanche Energy (Note 7) L = 0.1mH | E _{AR} | 10 | mJ | |

Thermal Characteristics

| Characteristic | Symbol | Value | Units | |
|--|-----------------------------------|------------------------|-------|------|
| Total Power Dissipation (Note 5) | P _D | T _A = +25°C | 0.66 | W |
| | | T _A = +70°C | 0.42 | |
| Thermal Resistance, Junction to Ambient (Note 5) | R _{θJA} | Steady state | 189 | °C/W |
| | | t < 10s | 132 | |
| Total Power Dissipation (Note 6) | P _D | T _A = +25°C | 2.03 | W |
| | | T _A = +70°C | 1.31 | |
| Thermal Resistance, Junction to Ambient (Note 6) | R _{θJA} | Steady state | 61 | °C/W |
| | | t < 10s | 43 | |
| Thermal Resistance, Junction to Case (Note 6) | R _{θJC} | 9.3 | | |
| 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} | 60 | — | — | V | V _{DS} = 0V, I _D = 250µA |
| Zero Gate Voltage Drain Current | I _{DSS} | — | — | 100 | nA | V _{DS} = 60V, V _{GS} = 0V |
| Gate-Source Leakage | I _{GSS} | — | — | ±100 | nA | V _{GS} = ±20V, V _{DS} = 0V |
| ON CHARACTERISTICS (Note 8) | | | | | | |
| Gate Threshold Voltage | V _{GS(th)} | 1 | — | 3 | V | V _{DS} = V _{GS} , I _D = 250µA |
| Static Drain-Source On-Resistance | R _{DS(on)} | — | 30 | 38 | mΩ | V _{GS} = 10V, I _D = 4.3A |
| | | — | 35 | 47 | | V _{GS} = 4.5V, I _D = 4A |
| Forward Transfer Admittance | Y _{fs} | — | 4.5 | — | S | V _{DS} = 10V, I _D = 4.3A |
| Diode Forward Voltage | V _{SD} | — | 0.7 | 1.2 | V | V _{GS} = 0V, I _S = 1A |
| DYNAMIC CHARACTERISTICS (Note 9) | | | | | | |
| Input Capacitance | C _{iss} | — | 1287 | — | pF | V _{DS} = 25V, V _{GS} = 0V f = 1.0MHz |
| Output Capacitance | C _{oss} | — | 57 | — | | |
| Reverse Transfer Capacitance | C _{rss} | — | 44 | — | | |
| Gate Resistance | R _G | — | 1.2 | — | Ω | V _{DS} = 0V, V _{GS} = 0V, f = 1.0MHz |
| Total Gate Charge (V _{GS} = 10V) | Q _g | — | 22.4 | — | nC | V _{DS} = 30V, I _D = 4.3A |
| Total Gate Charge (V _{GS} = 4.5V) | Q _g | — | 10.4 | — | | |
| Gate-Source Charge | Q _{gs} | — | 4.9 | — | | |
| Gate-Drain Charge | Q _{gd} | — | 3.0 | — | | |
| Turn-On Delay Time | t _{D(on)} | — | 6.6 | — | nS | V _{GS} = 10V, V _{DD} = 30V, R _G = 6Ω, I _D = 4.3A |
| Turn-On Rise Time | t _r | — | 8.1 | — | | |
| Turn-Off Delay Time | t _{D(off)} | — | 20.1 | — | | |
| Turn-Off Fall Time | t _f | — | 4.0 | — | | |
| Body Diode Reverse Recovery Time | t _{rr} | — | 18 | — | nS | I _S = 4.3A, dI/dt = 100A/µs |
| Body Diode Reverse Recovery Charge | Q _{rr} | — | 11.9 | — | nC | I _S = 4.3A, dI/dt = 100A/µs |

- 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_{AR} and E_{AR} rating 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.

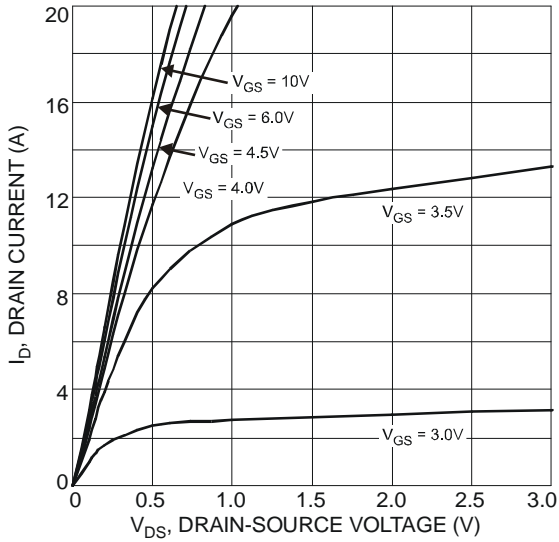


Fig. 1 Typical Output Characteristic

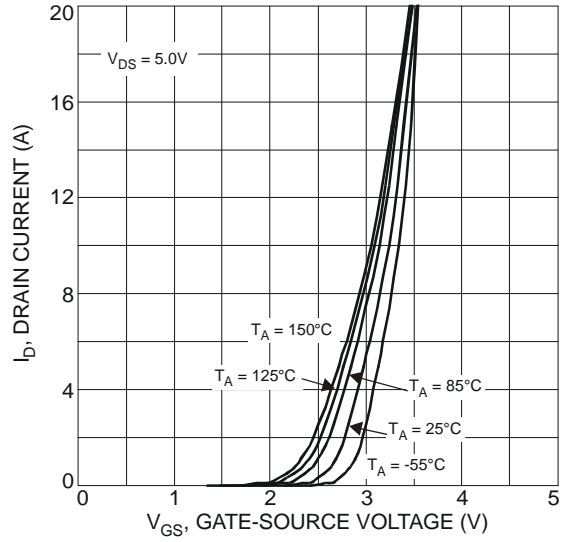


Fig. 2 Typical Transfer Characteristics

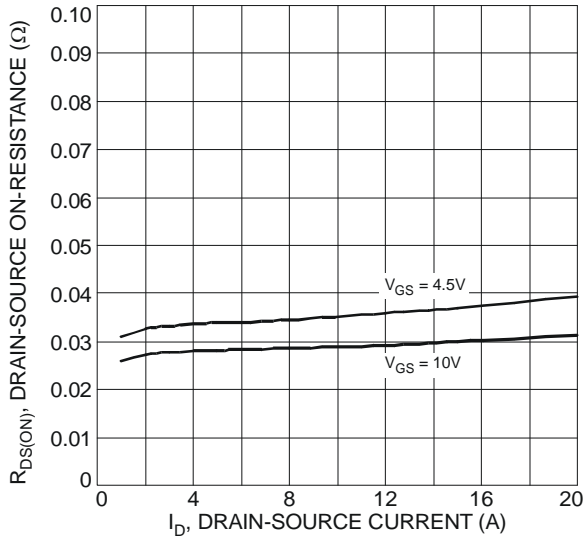


Fig. 3 Typical On-Resistance vs. Drain Current and Gate Voltage

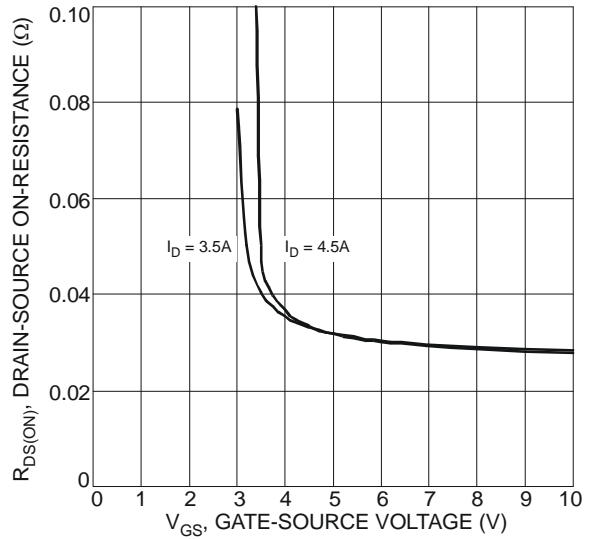


Fig. 4 Typical On-Resistance vs. Drain Current and Gate Voltage

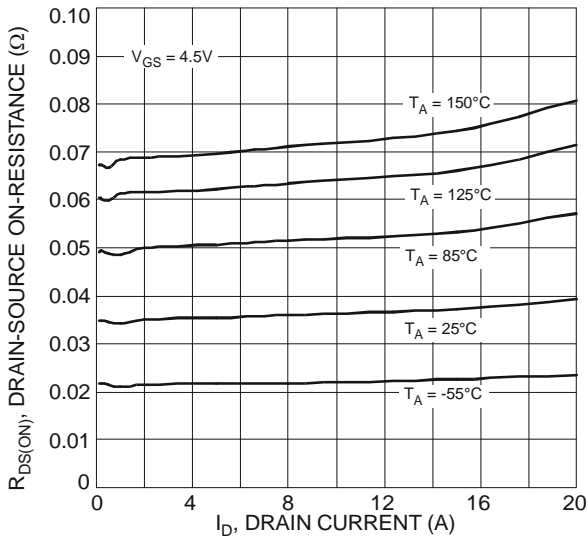


Fig. 5 Typical On-Resistance vs. Drain Current and Temperature

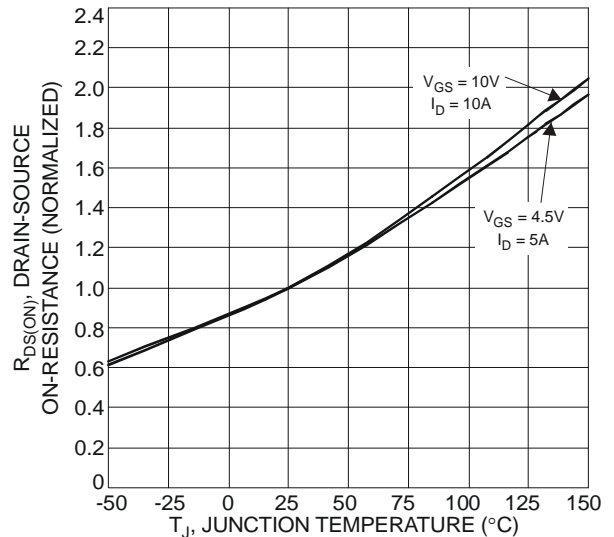


Fig. 6 On-Resistance Variation with Temperature

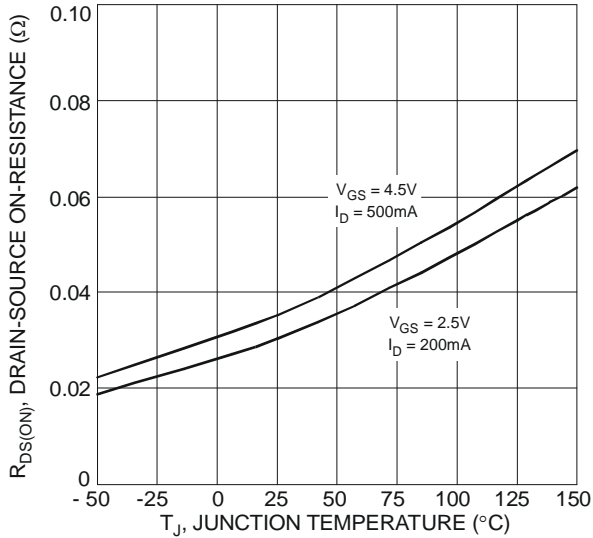


Fig. 7 On-Resistance Variation with Temperature

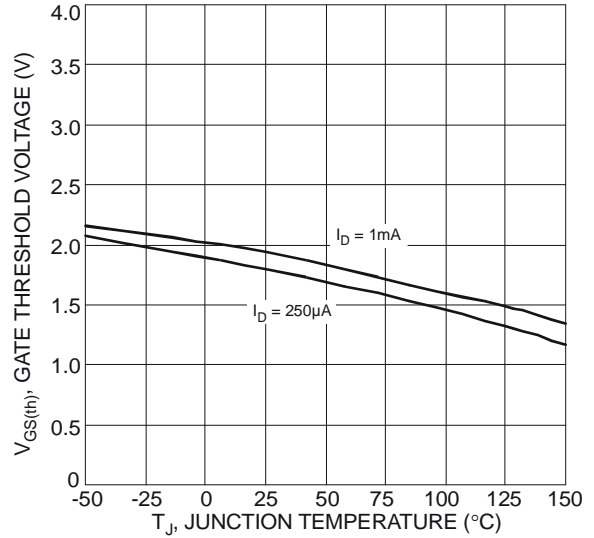


Fig. 8 Gate Threshold Variation vs. Ambient Temperature

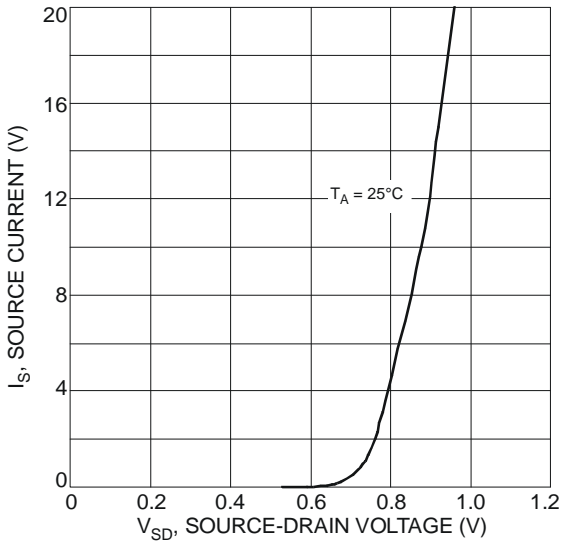


Fig. 9 Diode Forward Voltage vs. Current

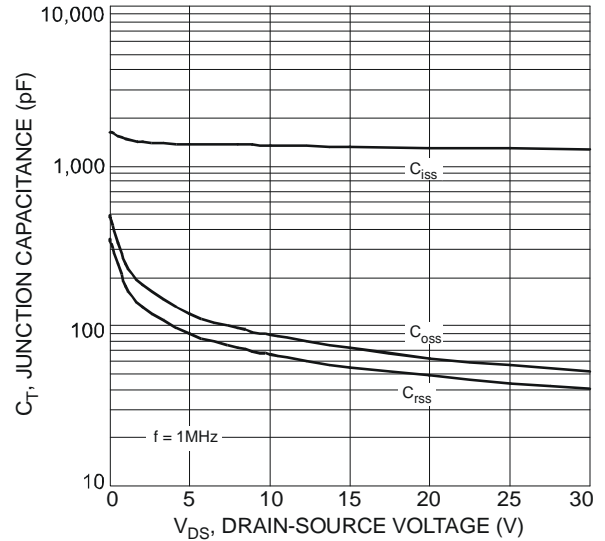


Fig. 10 Typical Junction Capacitance

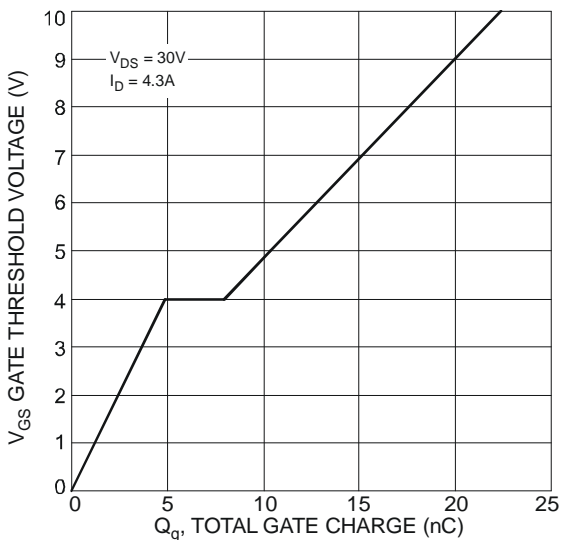


Fig. 11 Gate Charge

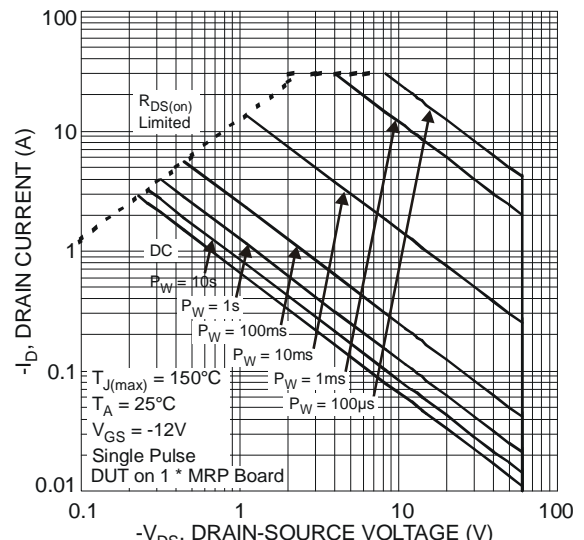
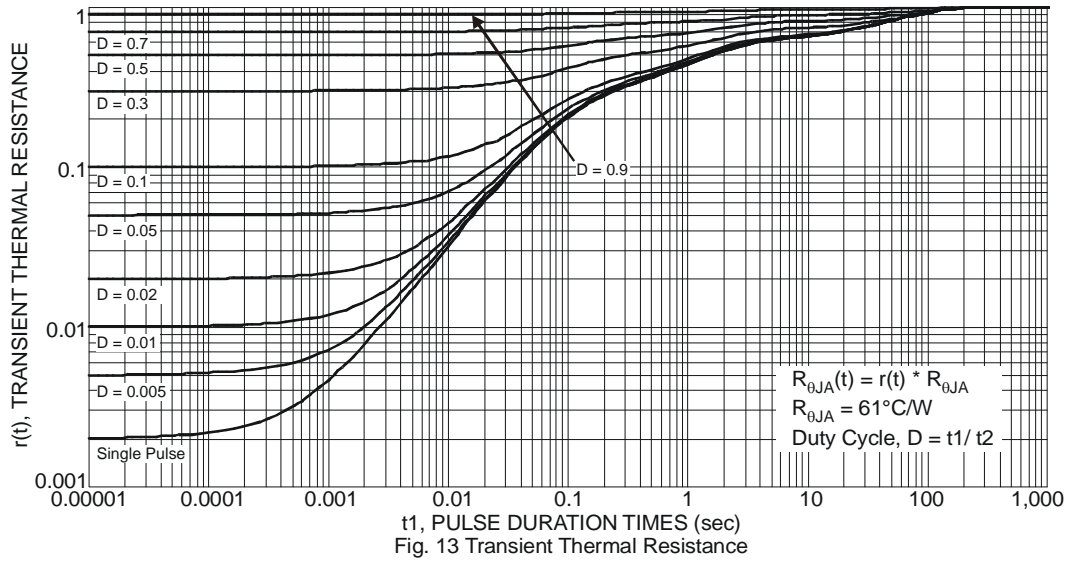
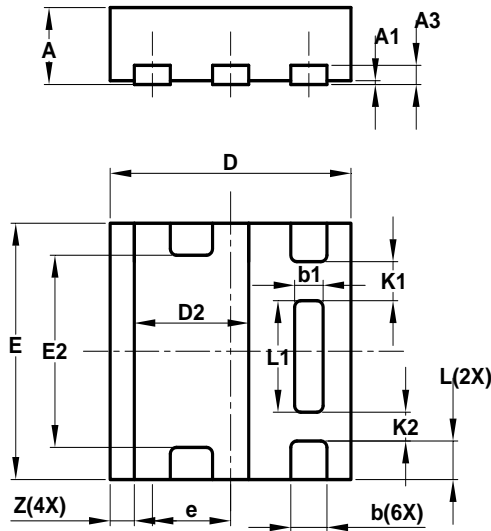


Figure 12 SOA, Safe Operation Area



Package Outline Dimensions

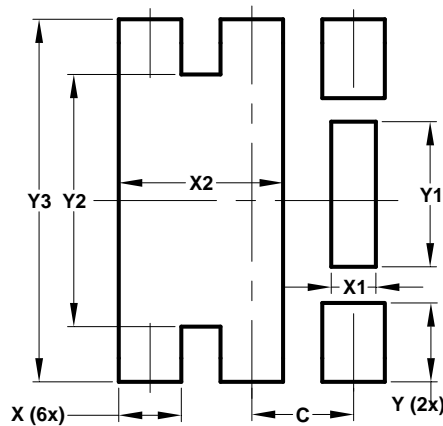
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for latest version.



| U-DFN2020-6 Type E | | | |
|-----------------------|-------|-------|-------|
| Dim | Min | Max | Typ |
| A | 0.57 | 0.63 | 0.60 |
| A1 | 0 | 0.05 | 0.03 |
| A3 | — | — | 0.15 |
| b | 0.25 | 0.35 | 0.30 |
| b1 | 0.185 | 0.285 | 0.235 |
| D | 1.95 | 2.05 | 2.00 |
| D2 | 0.85 | 1.05 | 0.95 |
| E | 1.95 | 2.05 | 2.00 |
| E2 | 1.40 | 1.60 | 1.50 |
| e | — | — | 0.65 |
| L | 0.25 | 0.35 | 0.30 |
| L1 | 0.82 | 0.92 | 0.87 |
| K1 | — | — | 0.305 |
| K2 | — | — | 0.225 |
| Z | — | — | 0.20 |
| All Dimensions in mm | | | |

Suggested Pad Layout

Please see AP02001 at <http://www.diodes.com/datasheets/ap02001.pdf> for the latest version.



| Dimensions | Value (in mm) |
|------------|---------------|
| C | 0.650 |
| X | 0.400 |
| X1 | 0.285 |
| X2 | 1.050 |
| Y | 0.500 |
| Y1 | 0.920 |
| Y2 | 1.600 |
| Y3 | 2.300 |

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